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SPECIAL ARTICLES

Secretary Ickes Names 2,130,000 Bbls. Per Day As Required Crude Production After Dec. 1 ---- 19
By JAMES McINTYRE

Physical Laws of Perfect Solutions ---- 20
By W. K. LEWIS

A.P.I. Moves to Strengthen Oil Code ---- 21
By ANDREW M. ROWLEY

Rating of Plant Capacities Discussed in Control Plan ---- 22
By C. O. WILLSON

Oil Administrator Tells A.P.I. of Government's Purpose 23
By HAROLD L. ICKES

Work of Planning and Co-ordinating Committee Explained ---- 25
By Chairman WIRT FRANKLIN

California and New Jersey Negotiations Off ---- 25

Ickes Issues Order on Production and Figures on Stocks 26

Advances in Maintenance and Repair of Oil Pipe Lines ---- 27
By WILLIAM G. HELTZEL

Two Points at Chicago (Editorial) ---- 34

Changing Conditions in Semi-Flush Pools Create Demand From Stripper Wells ---- 46
By L. G. E. BIGNELL

Secretary Ickes Suggests Relief Measure For Small Producers and Refiners ---- 48

Solvent Extraction Methods for Improvement of Lubribating Oil ---- 49
By JOHN W. POOLE and J. M. WADSWORTH

Tests on Special Alloys for Barrels, Balls and Seats ---- 54
By WALTER F. ROGERS

Should Automobile Specialties be Sold at Stations? ---- 58
By B. K. DAVIES

Commercial Application of Chlorex Process ---- 60
By W. H. BAHLKE, A. B. BROWN and F. F. DIWOKY

Corrosion Fatigue and Sucker Rod Failures ---- 65
By BLAINE B. WESCOTT and C. NORMAN BOWERS

Effect of Organic Coatings in Preventing Damage ---- 73
By F. N. SPELLER and I. B. McCORKLE

Sulphuric Acid Produced From Heavy Refinery Sludge 76
By S. F. SPANGLER

Furfural as Extraction Solvent ---- 78
By R. E. MANLEY, B. Y. McCARTY and H. H. GROSS

Automotive Engineers Can Help Themselves by Aiding Refiners ---- 84
By A. LUDLOW CLAYDEN

Good Mud Fluid and Control Devices Aid in Safe Drilling 86
By E. P. HUBBARD

Code Offers Opportunity and Responsibility ---- 100
By AXTELL J. BYLES

Field Problems From Readers ---- 122
Edited by THOMAS F. SMILEY

FIELD OPERATIONS

Late Fields ---- 48

West and North Texas ---- 94
By L. E. BREDBERG

East Texas ---- 96
By L. E. BREDBERG

Oklahoma ---- 103
By JAMES McINTYRE

Michigan ---- 106
By PAUL ELLIOTT

Central West ---- 106
By GEORGE A. WHITNEY

Eastern Fields ---- 107
By STAFF CORRESPONDENT

Rocky Mountain Area ---- 109
By TOLBERT R. INGRAM

Canada ---- 109
By VICTOR LAURISTON

California ---- 112
By L. P. STOCKMAN

Kansas ---- 115
By JAMES McINTYRE

Gulf Coast ---- 116
By W. A. SPINNEY

Southwest Texas ---- 117
By B. D. STEVENSON

North Louisiana-Arkansas, Mississippi ---- 118

REFINING AND MARKETING

Gains Recorded in Mid-Continent Refinery Market Notwithstanding a Week of Slow Trading ---- 36
By W. T. ZIEGENHAIN

New York Market ---- 37
By C. O. WILLSON

A.P.I. Refinery Report ---- 37

Refinery and Crude Prices ---- 38-39

Tank Wagon Markets ---- 40

News for Sales Departments ---- 41

News for Petroleum Refiners ---- 42

Natural Gasoline Manufacture ---- 43

Chicago Market ---- 46
By SPECIAL CORRESPONDENT

Technical Questions Answered ---- 129
By C. K. FRANCIS, Ph. D.

GENERAL DEPARTMENTS

New and Improved Equipment ---- 119

Natural Gas Developments ---- 120

Personal Paragraphs ---- 124-126

Do You Remember? ---- 126

Classified Advertising ---- 135

Index to Advertisers ---- 136

Refinery Section Starts on Page 36

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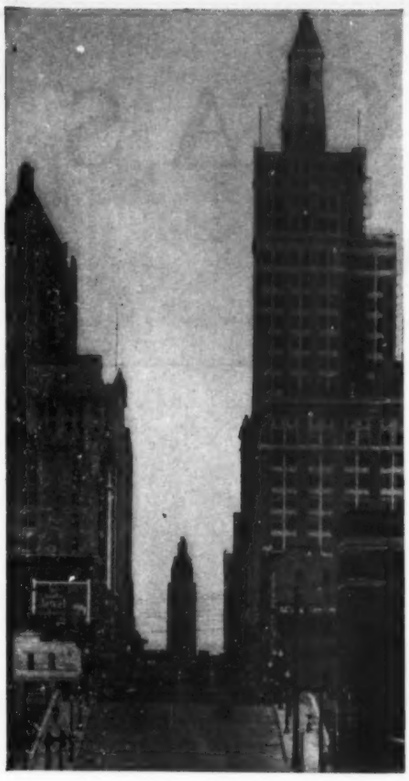

Boston Avenue, Tulsa, South from Union Station Plaza—National Bank of Tulsa Building on right.

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Secretary Ickes Names 2,130,000 Bbls. Per Day as Required Crude Production After Dec. 1

By JAMES McINTYRE

WITH the approach of the winter, and the seasonal decline in motor fuel consumption, Secretary of the Interior Ickes, head of the Federal Oil Administration has given notice that commencing December 1 and until January 31, the required crude oil production in the United States will be reduced to an average of 2,130,000 bbls. per day, or 208,500 bbls. per day less than the present allowable of 2,338,500 bbls. per day established October 1.

This will not come as a surprise to oil men who keep posted on the general oil situation and the influence of the seasons on motoring. From December 1 to April 1, in that part of the United States where gasoline consumption is the greatest, the winter weather generally is not conducive to pleasure driving. Millions of family cars are used during that period, not as a luxury, but as a necessity.

The allocation of the production under the new allowable will not be made until November 20. Meanwhile the Petroleum Board will be enabled to obtain statistics concerning changes in trade channels.

The Secretary made provision in the new order whereby producers holding small quantities of oil in storage may sell it to such buyers as will agree to hold it as stored oil, such oil to be the first permitted to be withdrawn from storage when there is an increase in seasonal demand.

Refiners are provided for in Secretary Ickes new order by an order that refiners who, because of low gasoline inventories, are not able to meet their market requirements from current production, shall be permitted to run to stills oil which has been stored or purchased under the provisions of the first mentioned order.

All the above changes are subject to the consent of the Planning and Co-ordinating Committee under the oil code.

Texas, Oklahoma and California have all overproduced since September 8, and have been so informed by Secretary Ickes who requires the governing bodies of the three states named to compensate for this overproduction by a further curtailment of production. The corporation commissions promptly promised co-operation in this respect but the Texas Commission has been notified by the Texas attorney general that overproduced oil may not lawfully be made up by forcing offending producers to make up all of the overproduction. This makes it necessary for the fair-dealing producer to bear part of the punishment for the sins of his less scrupulous neighbor.

Crude Oil Production in the United States

Estimated daily average production for the week ending October 21, and a comparison with previous week and one year ago, follows:

	Oct. 21	Oct. 14	Oct. 22, 1932
Oklahoma—			
Oklahoma City	211,520	180,330	79,265
Seminole-St. Louis	96,555	112,815	112,434
Remainder of State	211,745	214,410	207,791
Total Oklahoma	519,820	507,555	399,490
East Texas—			
Lathrop	193,757	207,441	139,903
Kilgore	140,850	150,177	108,116
Joiner	125,643	134,517	114,638
Total East Texas	460,230	492,735	362,651
West Texas	126,147	127,665	162,352
North Central Texas	79,836	81,215	72,104
Texas Panhandle	47,072	45,092	49,461
East Central Texas	45,305	45,628	51,908
Gulf Coast—Texas	186,985	186,665	118,286
Southwest Texas	49,385	47,810	58,044
Total State of Texas	994,960	1,026,810	874,806
Kansas	114,290	112,470	99,060
North Louisiana	25,970	25,820	29,995
Gulf Coast—Louisiana	48,037	47,210	34,927
Arkansas	32,940	32,925	33,870
Eastern Fields	129,300	130,000	119,000
Rocky Mountain area	80,700	80,480	74,391
California—			
Santa Fe Springs	46,500	46,500	77,250
Long Beach	59,300	61,750	67,500
Playa Del Rey	9,700	10,500	13,750
Elwood	14,000	12,900	14,000
Kettleman Hills	60,000	61,000	58,500
Remainder of State	277,500	282,100	254,750
Total California	467,000	474,750	485,750
Total United States	2,413,017	2,438,020	2,151,289

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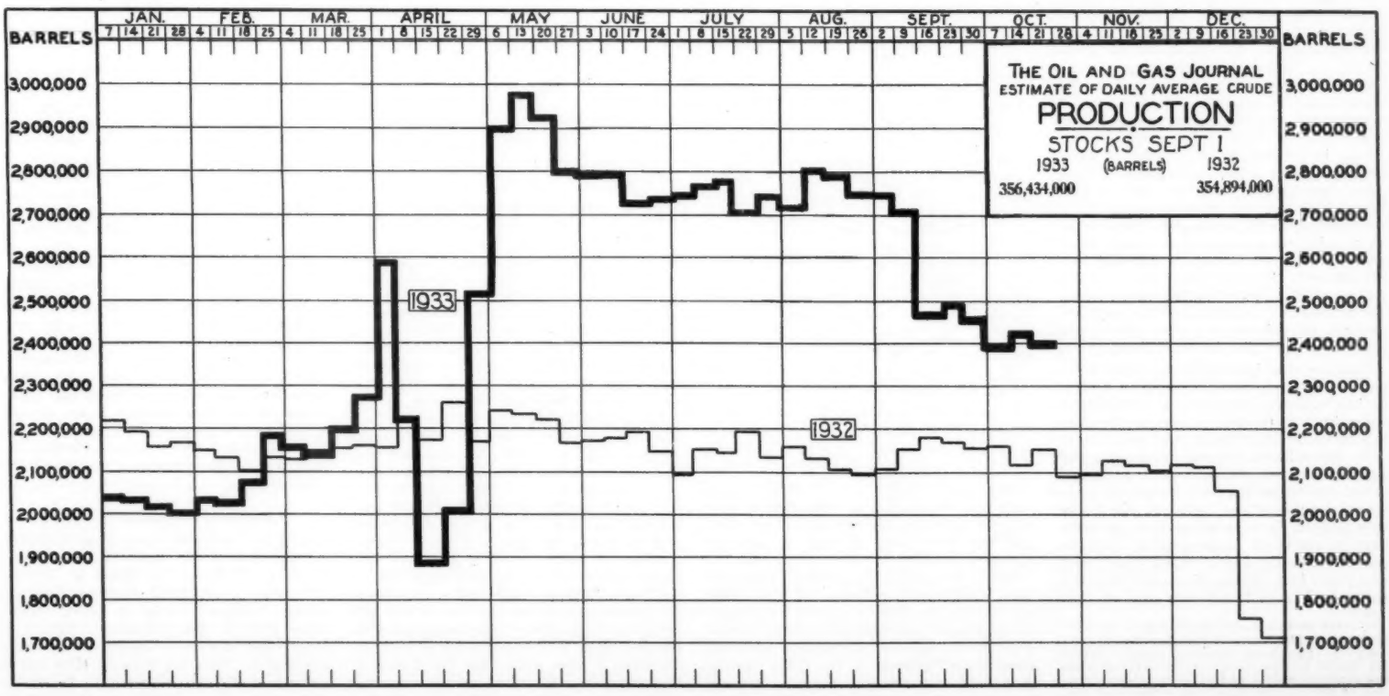

Physical Laws of Perfect Solutions Applied to Properties of Mixed Petroleum Hydrocarbons

By W. K. LEWIS *

From the point of view of vaporization, the behavior of a specific hydrocarbon mixture is shown in Figure 9. This figure represents the data on binary mixtures of pentane and heptane. The left-hand curve is the vapor pressure curve of the former and the right-hand one of the latter, each in the pure state. The intermediate curves represent the behavior of three specific mixtures of the two components, the composition of each mixture being indicated on its curve. If a pure substance be heated to its boiling point, it can then be transformed completely into vapor without change in either pressure or temperature, but the behavior of a mixture is in general otherwise. If the temperature of a liquid mixture be raised at contact pressure or if the pressure on it be reduced at constant temperature, a point is reached at which vaporization starts. This is called the boiling point of the mixture.[1] In general, if further heat be applied, maintaining the same limitations of operation, evaporation will proceed, but, unlike the behavior of a pure material, the temperature will continue to rise at constant pressure or the pressure to fall at constant temperature. Ultimately, however, the liquid phase will disappear and the process of vaporization will have completed itself. If the same mixture be held at a temperature sufficiently high and pressure sufficiently low it will exist entirely in the form of vapor. If, now, the temperature of this mixture be lowered at constant pressure or its pressure increased at constant temperature, a point, called the dew point, will be reached at which condensation starts. The dew point is the endpoint of the process of vaporization described above.

Evaporative Behavior

The three loop curves of Figure 9 represent the evaporative behavior of the mixtures of pentane and heptane specified. The upper limb of each loop is the boiling point curve of the mixture in question and the lower limb its dew point curve. The top curve of the diagram extending between the critical points of the components is the locus of those points at which corresponding boiling point and dew point curves meet. At these points the mixture has the same density and other physical properties as vapor and as liquid and two phases differing in properties can no longer exist in equilibrium with each other. These points are critical conditions for the mixtures. However, the right hand extremity of each loop is the maximum temperature at which any condensation whatever is possible from each specific mixture and consequently likewise represents a critical condition. The first group of points are called the Cr. 1 points of the mixtures and the second, Cr. 2 points. For pure components the two become identical.

These curves have been determined for only a relatively small number of hydrocarbon mixtures and almost all of these were limited to binary mixtures. Consequently, at first blush one would consider generalization to the extraordinarily complex mixtures encountered in crude petroleum unjustifiable. However, theoretical considerations based on the phase rule lead to the conclusion that all ordinary mixtures of hydrocarbons, however complex, should have boiling point and dew point loop curves of exactly the type shown in Figure 9, differing only in that the presence in the mixtures of components varying enormously in volatility greatly widens the range of the diagram. This conclusion is fully substantiated by the limited amount of experimental work which has been done. Consequently, one can with assurance look upon these loop curves as representative of the behavior of hydrocarbon mixtures under changes in pressure and temperature. However, the engineering utility of the relationships would be extremely limited were it not possible to put them on a satisfactory quantitative basis.

Laws of Perfect Solutions

In order quantitatively to solve the problems of vaporization one must be able to compute the vapor pressure and vapor compositions of liquid mixtures and to do this one takes advantage of the so-called laws of perfect solutions. At low pressures these take the form of Raoult's and Dalton's Laws. The former states that the partial pressure of a volatile component in a liquid is equal to its mol fraction in the liquid times its pressure at the same temperature in the pure state. The latter asserts the additivity of partial pressures, the total pressure of a vapor mixture being equal to the sum of the partial pressures of the components. The partial pressure of each component is the pressure which it would exert at the same temperature in the same space in the absence of the others.

Raoult's Law. $p = Px.$

Dalton's Law. $\pi = \Sigma p.$

Combined with Avagadro's Law, these are equivalent to

$$p = Px = \pi y.$$

For any conditions in which these equations are applicable they make it possible to calculate the initial boiling point and the dew point of any mixture of known composition, the composition of liquid and vapor in equilibrium with each other and the percentage of the total mixture in the form of liquid and vapor for any specified condition. This is true even in the case of mixtures of extreme complexity, because it has been shown that such mixtures can be characterized in terms of the so-called true boiling point curve, i.e., the boiling point of each individual constituent in the mixture plotted against the cumulative fraction of all constituents of lower boiling point, up to and including this particular temperature level, together with the boiling point-molecular weight relationship. Beginning in the light naphtha range and above, petroleum mixtures behave as though they consisted of an indefinitely large number of components, differing only differentially in boiling point. However, each differential portion can be treated as an infinitesimal amount of a pure component. Its vapor pressure curve can be estimated, e.g., by means of the Cox chart, because one point on this curve is known, namely, the boiling point. Its molecular weight makes it possible to convert weight fraction into mol fraction. Thus, one is in a position to evaluate the differential partial pressure of each constituent, however small its amount, and obtain total pressures and vapor compositions by graphical integration.

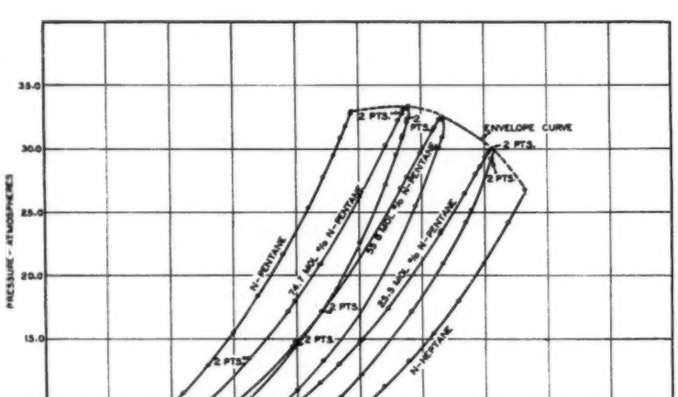

Fig. 9

Substitute Fugacity

However, the computation methods just outlined suffer from the limitation that they are grossly inaccurate at high pressures, particularly above a few hundred pounds, a situation which renders them almost useless for the production engineer. This situation is overcome through generalized methods of correction of the solution laws for the effect of pressure, based upon the high pressure behavior of pure hydrocarbons discussed above. While the solution laws in the familiar form given above, $p = Px = \pi y$, break down at high pressures, one can still use them in the same form, if, instead of the pressure terms which they contain, one will substitute the fugacities. The fugacity applies only to a single component and never to a mixture as a whole. Thus, a mixture exerts a total pressure but possesses no such thing as a total fugacity. In a mixture, therefore, under pressures low enough for the use of the gas laws, the fugacity of the component is the equivalent of its partial pressure. The fugacity is designated by the letter f. The subscript, P, indicates the fugacity of the pure component at the temperature in question and π, its fugacity in the pure state at the total pressure. π. Thus, the solution laws become $fx = f\pi y$. On the assumption that hydrocarbon liquids mix isothermally without heat effect or change in volume and that the same is true of hydrocarbon vapors at constant pressure, the fugacities to be employed in this equation can be compute from the properties of the pure hydrocarbons and, furthermore, it is possible to express them in terms of reduced temperature and pressure. The results thus computed are shown in Figure 8. It is seen that the ordinates for this figure are the ratio of fugacity to the corresponding pressure. The fugacity itself is obtained by multiplying by the pressure. Since the fugacity is the corrected pressure, it is clear that the units in which the fugacity is expressed are those of the pressure by which this ratio is multiplied. This equation, together with the plots, makes it possible to calculate equilibrium concentrations of vapor and liquid under any conditions, irrespective of pressure, so long as the underlying assumptions are valid. However, it is important to point out that fugacities, unlike partial pressures, are not additive.

The validity of these relationships for hydrocarbon mixtures, both simple and complex, has been tested experimentally over considerable ranges and found on the whole dependable. However, deviations from the solution laws do occur, although among hydrocarbons they are usually relatively limited. They are most serious where the hydrocarbons in question differ most widely in structure, as for example, between aromatic and paraffinic compounds. Efforts are under way to enable one to predict the effect of such differences, but the complete solution of this problem rests with the future. Fortunately, in a given crude, the differences between constituents are usually at a minimum, thus tending to lessen divergencies from calculated behavior. These methods of computation are recommended as representing the best available in the present state of our knowledge.

At temperatures above the critical of any given component, these computation methods break down for that component in the sense that the component can no longer exist as a liquid in equilibrium with a saturated vapor of properties different than its own. However, it is well recognized that such components will dissolve in liquids and the question arises as to the mechanism of solution and the methods of computation.

WILL REPRESENT CONSUMERS

Dr. Walton Hale Hamilton of Yale university will represent the consumers advisory board at the hearing to be conducted by the petroleum administrative board on the schedule prices for petroleum and its principal products which Secretary of the Interior Ickes, its administrator under the petroleum code, has announced will become effective December 1. The hearings are to begin October 30.

LUDWIG SCHMIDT HURT

Ludwig Schmidt, petroleum engineer, connected with the Experimental Station of the U. S. Bureau of Mines at Bartlesville, Okla., met with a painful, but not serious accident while at Niles, Mich., while driving from Midland, Mich., to Gary, Ind. He was obliged to go to a hospital at Niles for a short time but is resting easily and expected to be out in a few days.

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*Part 1 of this paper published in October 19 issue of The Oil and Gas Journal.

[1] In the petroleum industry usually called the initial boiling point, to distinguish from the conditions obtained after a certain fraction of the mixture has been evaporated and removed from the system.

A. P. I. Takes Action to Strengthen Oil Code; Proposes Tightening of Commerce Rules

By ANDREW M. ROWLEY

CHICAGO, Oct. 24.—A far better understanding of the new deal in the petroleum industry under the NRA and the code is permeating every branch of the business as a result of hundreds of conferences being held here in connection with the fourteenth annual convention of the American Petroleum Institute.

This convention undoubtedly is one of the most important held in the oil business from the standpoint of the direct benefit so many are getting from these informal talks and discussions about present conditions and what is going on in Washington. It is the first general meeting of oil men from every section of the United States since the NRA began operating; since the code for the petroleum industry was made effective by President Roosevelt, and since minimum prices were promulgated for crude oil and refined products throughout the country.

Naturally the paramount question is the wisdom of the Federal Government's establishing prices for crude oil and its products. Differences of opinion on this subject are being cleared up to a great extent as views are exchanged and the attitude of many leaders in the industry is explained. The industry is almost unanimous in the belief that fundamentally the policy or practice of having the Federal Government fix prices is not to be desired. It is safe to say a large majority of the strongest adherents of the recent action of Harold L. Ickes, Secretary of the Interior and oil administrator, in announcing price schedules for crude oil and refined products are against price fixing by the Federal Government as a permanent proposition or a lasting policy.

Benefit the Industry

But there is very definite feeling upon the part of many that this action of Secretary Ickes will benefit the petroleum industry at this time and will be of the greatest help in aiding the industry solve one of its most perplexing problems—that of price wars and price cutting on the part of a small minority in the business.

Charles L. Suhr, president of the Pennzoil Co. of Oil City, Pa., aptly expressed the viewpoint of many oil men when he said: "We were like a bunch of wild horses running aimlessly on the prairie. We liked our freedom and when someone put a halter on us we didn't like it, although it is better for us. Personally, I would rather have this group of men now functioning in Washington fix prices for the petroleum industry than to have those prices fixed by the owner of a hot dog stand who sells about 100 gallons of gasoline."

There can be no denial of the fact price cutters in the petroleum industry have set prices both for crude oil and gasoline. It has been a case of the tail wagging the dog, for the result of selling hot oil under regularly posted prices certainly wrecked the crude oil price structure and brought an era of distress and ruinous prices, just as the cut prices at filling stations resulted in gasoline being sold below the cost of manufacture.

Franklin's View Appeals

Wirt Franklin, chairman of the Planning and Co-ordinating Committee, holds a view on the price question which is appealing strongly to many oil men and which presents an entirely different angle to the subject. He says the Federal Government has not fixed prices for the petroleum industry but has only established a schedule of minimum or cost prices below which crude oil and its products must not be sold, in order to prevent unfair competition.

He pointed out that the Clayton Act prohibits the sale of products at prices below the cost of manufacture and the recent act of Secretary Ickes in announcing minimum prices for crude oil and refined products is simply applying principles of the Clayton Act to the petroleum industry.

Mr. Franklin pointed out that the prices announced by Secretary Ickes were minimum prices, and were based on costs of production and manufacture. He said there could be no objection to preventing unfair competition by prohibiting the sale of products at prices below the cost of recovery or manufacture and that there is no restriction upon a normal functioning of the economic law of supply and demand. In other words, there is no fixing of prices above the minimum level and this minimum or base price was established solely to prevent unfair competition.

Mr. Franklin declared he believed a very large majority of the members of the Planning and Co-ordinating committee who voted in favor of having the Federal Government establish minimum prices would vote strongly against any proposal to have the Government fix prices for the industry. He said the expression fixing prices is a misnomer, that prices really have not been fixed but only a base or minimum level established to prevent unfair competition by those who would cut prices and sell below the actual cost of production or manufacture.

Crude oil production is another question receiving serious attention of oil men attending this convention. They realize strict curtailment to consumer demand is absolutely necessary at this time to assure stability for the industry and a living price for crude oil and gasoline. The matter of withdrawals from storage also is a pertinent subject for discussion.

Move to Strengthen Code

The American Petroleum Institute today took action looking towards the strengthening of that section of the code for the petroleum industry dealing with crude oil production allocations and limits. Because of suits which have been filed attacking the validity of regulations of the Federal Government in regard to crude oil production quotas for the various states, it was deemed necessary to recommend to President Roosevelt that the present code be amended by inserting a new section as follows:

"Upon a finding by the President or the Federal agency that interstate commerce in crude petroleum or the products thereof is injuriously affected by an oversupply of crude petroleum in the United States, and that commerce in petroleum and the products thereof is such that any remedy, to be effective in respect to interstate commerce, must incidentally apply in like manner to intrastate and foreign commerce, the President or the Federal agency may establish quotas in commerce for crude petroleum from all or any of the various pools and properties and storage sources in the United States, and while such quotas are in effect no person shall place in commerce or receive in commerce (foreign, interstate or intrastate) by sale, exchange or consignment, any crude petroleum in excess of quota, and a violation of this provision shall be deemed unfair competition, and unfair trade practice, and a violation of this code."

Would Strengthen Code

It was pointed out during discussions of this question and the consideration of the proposed amendment that there is a clear cut issue of whether orders made under the code as now written are valid an enforceable in respect to crude oil production within the state. In the case instituted by the McMurrey Corp. in Federal Court in Texas against members of the Texas Railroad Commission and the attorney general of Texas it was claimed orders of the Railroad Commission of September 5 and September 30, limiting production in the State, were not made in accordance with state law but were made pursuant to an order of the petroleum administrator and that the commission did not follow the procedure outlined in the state statute and ignored nominations and a market demand substantially in excess of the production allowed.

Commerce, under Federal Court decisions, does not begin until manufacture is finished and hence the commerce clause of the Constitution does not prevent the state from exercising exclusive control over the manufacture. Under such an interpretation neither the production of oil nor the manufacture of refined products can be held to constitute commerce. In the case of petroleum, which moves across state lines and in which a small part of the production is consumed in the state where it is produced, or where the refined product is manufactured, both interstate and intrastate commerce are involved.

Question of Authority

In the oil business where a large part of the business is interstate or foreign and that portion which is intrastate directly affects the interstate and foreign portions, the question of authority to regulate becomes one which will admit of only one solution, namely regulation by Congress of the interstate and foreign portions, which carries with it the prevention of anything in intrastate commerce which would tend to thwart such regulation.

In other words the effort of Congress to regulate interstate commerce would be ineffective if intrastate commerce in the same commodity should not be controlled.

Under the proposed amendment production of crude oil in excess of state quotas could not be prevented if such production were not shipped from leases and entered into commerce. Producers

Institute's Usefulness Is Not Impaired by Work of Federal Oil Administration

By ANDREW M. ROWLEY

CHICAGO, Oct. 23.—Clarification of the atmosphere in regard to the situation at Washington and what the petroleum industry may expect from operation under the NRA and code, resulting from discussion at the annual convention of the American Petroleum Institute here this week, has emphasized in the minds of many oil men the especial need and importance during this period of the American Petroleum Institute. There have been some rumors to the effect that the activities of the Institute would be curtailed drastically and that the Planning and Co-ordinating Committee would function in place of the Institute.

Whatever was left of these rumors has been dissipated at the meeting here. The Planning and Co-ordinating Committee is a body appointed by the President and is, in reality, a government organization. This committee must of necessity look to the petroleum industry for suggestions and recommendations in matters affecting the oil business which the committee must consider. The American Petroleum Institute is the only organization of the petroleum industry in position to express the views of the oil men and of the oil business.

During the next two years the oil industry must make its plans for a continuance of its operations on a sound and stable basis when the time limit of operations under the NRA and the code expires. None in the business wants government regulation and everyone realizes the industry must have its house in order and demonstrate conclusively during the next two years it is capable of self-government if it can expect the Government to step out of its present role of practical dictator. The Institute is the vehicle through which it is expected such necessary plans will be formulated and made effective.

In addition the functions of the Institute before the inauguration of the NRA and the regulation under the code are as important now as they were then. The engineering and technical committees of the Institute are doing a great work on problems and matters of interest to the industry as a whole and this work will benefit every branch of the oil business and every company in the industry. Results of all this work are available to every company and individual in the business.

The question of expense naturally is important in considering the work of the Institute because the oil industry expects it will have to finance the expenses of maintaining the Planning and Co-ordinating Committee. But if conditions within the petroleum industry are stabilized and prices obtained which will permit of a reasonable profit there is little question but what sufficient funds will be contributed to maintain the Institute and permit it to continue its present activities and work.

The code committees of the Institute have been dismissed because these committees are really working now under the NRA. The activities of the Marketing Division of the Institute, to a large extent, have been transferred to the NRA with the result the Institute personnel engaged in work of the Marketing Division has been reduced and transferred to committees operating in Washington under the NRA. Other members of the staff of the Institute in New York will take over some of the work previously done by employes of the Marketing Division and the work of the technical and other committees in the Marketing Division will continue as heretofore.

could store such production but it is entirely unlikely they would do so because of the excessive cost of such action and, because most producers inclined to produce more than their quotas do so because they need money from the sale of such production and the amendment to the code would prevent the sale of this crude oil or its movement from the point of production. It was stated overproduction in itself did not cause trouble but it is the moving of this production to markets which wrecks these markets.

Directors' Action Approved

Directors of the Institute yesterday considered the resolution making application to President Roosevelt to amend the code, and they held a special meeting this morning at which the resolution and proposed amendment were approved.

The resolution and proposed amendment then were presented to the board of councillors of the Institute and that body of several hundred prominent oil men gave its approval this morning.

At the first general session of the convention this afternoon the matter was placed before the entire membership of the Institute and was again approved. It is very rare that any matter approved by the board of directors is placed before the board of councillors and then before the membership of the Institute so the proceedings today showed clearly the importance attached to the amendment and the desire that it receive the consideration and approval of the entire membership of the Institute.

Many Conferences Held

Members of the Planning and Co-ordinating Committee are attending the convention and are holding daily meetings at the Stevens Hotel. They are conducting the routine business of the committee and considering questions and problems arising in connection with the code and regulations of the oil administration. Many applications have been made to the committee for permits to withdraw crude oil from storage. Unusual circumstances prompt many of these applications and the committee is endeavoring to handle the question in the best way possible to prevent undue hardship on any oil man and yet not allow large quantities of crude oil to be taken out of storage and added to the market surplus.

Minimize Storage Withdrawals

There is a feeling among members of the committee that crude oil withdrawals from storage should be held to an absolute minimum, if not prohibited entirely until next spring. But there are cases where operators stored crude oil on money borrowed from banks and the present higher prices permit a profit which is needed, or the banks desire the loan settled. In either case the crude oil must be sold. In such cases efforts are being made to have some larger company buy this crude and agree to store it in its own tanks and not place it on the market. The committee is swamped with such problems and is endeavoring to get the regional committees functioning as soon as possible so that these regional committees can handle all matters of local interest.

Every Branch Represented

Every branch of the industry is represented at the convention. The attendance so far exceeds all expectations and the meeting bids fair to be one of the largest held in years. Naturally some were attracted by the World's Fair but many came to find out for themselves just what is going on and how things are being done in Washington. There are many informal discussions on the coming hearings in Washington on the prices announced by Secretary Ickes and which, with possible revisions, are due to become effective December 1. Numerous objections are expected to be made to different schedules at these hearings in Washington and it is considered probable the right of the Government to establish any price for the industry will be challenged. Whether this challenge will take the form of court action is somewhat doubtful at this time.

To Dallas Next Year

The board of directors of the Institute decided yesterday (Monday) to hold the fifteenth annual meeting of the Institute next year in Dallas, Tex. Capt. J. F. Lucey, of Dallas, for years a director of the Institute, presented the invitation of Dallas and promised every oil man would be shown an exceptionally good time if the meeting were held in that city. A barbecue for 5,000 persons at the State Fair Grounds in Dallas was one of the alluring promises presented by Captain Lucey. The executive committee will decide later this week as to the exact date of the convention next year although it is believed the first week in November will be set.

Spirit of Optimism

A spirit of optimism pervades the convention. Many oil men from different sections of the country say for the first time in three years they believe stabilization is in sight for the petroleum industry and that producers, refiners and equipment manufacturers soon will be able to operate at a reasonable profit.

The different committees of the Institute have been holding sessions here since last Friday. Group sessions of the refining, producing and marketing divisions starting this morning with morning, afternoon and night meetings for each division. Problems relating to the technical and engineering work of the business are being discussed by men especially fitted by their work to tell the latest developments and all sessions are being largely attended.

Thomas A. O'Donnell, first president of the American Petroleum Institute, who served five consecutive terms as head of the organization, is attending the convention. Mr. O'Donnell has been in Europe, after an illness during the past year, and came to Chicago direct from the boat which brought him back to this country. He was given quite an ovation at the meeting of the board of directors yesterday. He has been a director of the Institute since it was founded.

It is believed the board of directors will elect Barney Majewski of Chicago, and Ralph Zook of Bradford, Pa., as directors of the Institute. These members of the Planning and Co-ordinating Committee are the only oil industry members who are not now directors of the Institute.

Election of Directors

At the general session of the Institute this afternoon the following, nominated this morning by the board of councillors, were elected as directors of the Institute: George Legh Jones, Shell Petroleum Corp.; W. C. McDuffie, Pacific Western Oil Co.; B. B. Brooks, Consolidated Royalty Oil Co.; H. V. Foster, Indian Territory Illuminating Oil Co.; J. Edgar Pew, Sun Oil Co.; Frank Phillips, Phillips Petroleum Co.; Charles F. Roeser, Roeser & Pendleton; O. D. Donnell, Ohio Oil Co.; R. D. Matthews, Union Oil Co. of California; T. A. Dines, Salt Creek Producers Association; J. M. Miskell, Empire Refineries, Inc.; C. L. Suhr, Pennzoil Co.; W. H. Ferguson, Continental Oil Co.; E. G. Seubert, Standard Oil Co. (Indiana); L. J. Drake, Union Tank Car Co.; W. T. Holliday, Standard Oil Co. of Ohio; D. E. Buchanan, Hanlon and Buchanan, Inc.; Richard Airey, Asiatic Petroleum Co.; H. L. Pratt, Standard Oil Co. of New York; T. B. Gregory, Manufacturers Light & Heat Co.; J. D. Collett, O'Keefe and Collett; H. T. Klein, Texas Co.; Frank R. Coates, Henry L. Doherty & Co.; W. N. Davis, Phillips Petroleum Co.; R. C. Holmes; F. A. Leovy, Gulf Production Co.; E. W. Marland; H. C. Weiss, Humble Oil & Refining Co.; H. F. Sinclair, Consolidated Oil Corp.; J. W. Van Dyke, Atlantic Refining Co., and E. B. Reeser, Barnsdall Oil Corp.

ALLRED'S UNFAVORABLE OPINION

AUSTIN, Tex., Oct. 24.—Attorney General Allred in a departmental opinion today advised the Railroad Commission that the commission could not lawfully compel operators who have produced in excess of their allowables as fixed by the orders of the commission to make up the overproduction by a curtailment of their allowable production in the future.

The commission sought the ruling after receipt of a telegram from Secretary of the Interior Ickes informing it that Texas had overproduced 1,000,000 bbls. since September 8, and that this must be made up. The attorney general's ruling will have the effect of forcing operators who have not overproduced to share a part of the burden of compensating for the excess oil.

Rating of Plant Capacities Is Being Discussed in Connection With Refinery Control Plan

By C. O. WILLSON

CHICAGO, Oct. 24.—A method of rating refining capacities which reflects changes in manufacturing operations in recent years and which will give statistical committees on the oil industry and the Government more accurate information is in prospect as a result of discussions which have taken place in connection with the annual meeting of the American Petroleum Institute. This development, which has been discussed by individuals in the refining branch for several years, is now assuming major importance due in part to the fact that under the NRA code for the industry representatives of the Government are now completing plans for the control of refinery operations. At this time the industry does not have an adequate method of rating capacities of plants together with the fact that there is need of definitions for certain terms covering refinery operations and products.

A subcommittee of the refinery technology group has been working on this problem for several months and made a report at a committee meeting here Monday. Final action in the matter will probably come from the Institute's board of directors. At present the refining industry for the most part continues to rate capacity of plants based on their supposed daily capacity for refining crude oil. This is a hangover from the early days when refining operations were confined to the operations of batch stills and this method was reasonably accurate in indicating the maximum operating capacity. This has been supplemented in recent years with capacities of cracking equipment with estimates arrived at in practically the same manner. Some refiners continue to include in their rated capacities, equipment that is obsolete and is either shut down or operated only part time. With modern refinery equipment there is considerable flexibility in capacity to handle raw materials and also the characteristics of the products secured as finished products. It is believed that these variations should be taken into consideration and an attempt made to secure a uniform method of reporting operating capacities which will give the industry an accurate yardstick in determining refining operations. It is pointed out that this will greatly aid in the statistical studies now being made of the entire industry in the program of stabilizations of production and control of prices.

Important Committee Reports

Committee reports of special interest to refinery technologists have been one of the important features of the Institute's meeting this year, the reports showing that the industry has made substantial progress in several fields of cooperative activity. While final reports are not available in most cases the manufacturing branches have been given valuable data as a guide to their operations.

The matter of improving the work of commercial laboratories that make analyses of petroleum products for buyers or transactions within the industry was discussed and there was agreement that some system of control for these laboratories was desirable. In some cases these laboratories do not have the personnel or the equipment to make accurate tests of products with the result that it has worked a hardship on refiners. Several suggestions were made as to how this problem could be handled and the investigation will continue.

A report made by representatives of the Bureau of Standards covered recent investigations in regard to motor fuels. One angle of this investigation has to do with alcohol blends which will come up for consideration again this winter with the opening of Congress. It appears that the oil industry will have additional data to present in opposition to the proposal to enact national legislation compelling the use of alcohol blends, based both on the quality of the fuel and also the additional cost to the consumer.

Performance of Motor Fuels

Additional data on performance of motor fuels in automobile engines with special reference to volatility has emphasized the fact that car manufacturers can aid in making better fuels available through the design of their engines. Most manufacturers have changed their fuel systems and other features of design with the view of minimizing vapor lock with highly volatile fuels.

A concrete example of the value of committee work has been apparent in the wide distribution of a manual of fire prevention at refineries prepared earlier in the year. There has been a large demand for this manual outside as well as within the industry.

The program of standardization of certain equipment and materials used in refineries reported steady progress. The scope of this investigation has been widened.

The plan of establishing international standards for testing petroleum and its products does not appear so far distant as it has in the past. Dr. R. P. Anderson, secretary of the refining division, reported on a meeting of the Intednational Standards Association which he attended at London last summer. This work is being handled through the American Society for Testing Materials. Promise of continued co-operation on the part of the Institution of Petroleum Technologists was given by Dr. A. E. Dunstan, head of the research and development work of the Anglo-Persian Oil Co. of London, England. Doctor Dunstan appeared on the program of the refining division on Tuesday.

Three general meetings of the division of refining were held. A symposium of the use of selective solvents in refining lubricating oils featured these meetings with several other papers on subjects of special interest to refinery technologists.

Administrator Ickes Tells Institute Membership Government's Purpose in the Oil Code

By HAROLD L. ICKES
Secretary of the Interior and Oil Administrator*

Oil. The very word arouses our interest and appeals to our imagination. Oil is the vivid, romantic figure of industry today. In former generations men used to go down to the seas in ships to seek high adventure. Now they explore impenetrable jungles and trackless deserts seeking oil. The alchemist of old in his secret chamber sought to convert base metal into gold. The alchemist of today, whom you term a "wildcatter," knowing that oil is gold, hopefully drills well after well and perseveres through a long succession of dry holes. He pushes on, hoping always for the big strike that will reward him for all his wasted efforts. Possessing almost feminine qualities, this seductive and elusive product one day reduces a man to despair only to raise him the next to the heights of satisfied desire. It has been said that an oil man is one who is either a foot from a million dollars or a million feet from a dollar.

It is not to be wondered at that oil has possessed an irresistible lure for the adventurous, the strong and often the ruthless. It is no game for the weakling. To succeed in oil, men must be willing to risk their all, to persevere to the end, to endure beyond the point of human endurance. After having achieved their goal they must be tenacious to hold what they have gained, to beat back him who would deprive them of their gains. If he is not himself to run amuck he must possess and be able to exercise sufficient self-restraint to respect the rights of others. But he must ever be alert. He can never rest on his laurels. The urge in him, as irresistible in its impulse as the oil gushing from an unharnessed well, pushes him ever on to new discoveries and to new accomplishments. It is an industry in which only the strong can survive. But these strong men, if they are to serve the common cause, must also be just men. They must be considerate men, considerate of their competitors, considerate of those who handle their product, considerate of the consumers of their oil. Above all, they must have a patriotic regard for the best interests of the Nation.

Of Concern to Government

The Nation, despite the present apparent superabundance of oil, has less oil, measured in terms of known supply at the current rate of consumption, than it had 10 years ago. Yet oil is an irreplaceable natural resource. We can replant ruthlessly cut-over forest lands. We can, by taking thought, rearrange and redistribute our water supply. We can restock our streams with fish and our mountain haunts with game. We can moderate or deflect the rays of the sun. We can restore the fertility and the quality of our soil. But we cannot by any act of magic replace a single barrel of oil that has been taken from the ground. For this reason the conservation and proper use of our oil resources are a matter of major concern to the Government.

Essential as oil is to our happiness and well-being as citizens it is absolutely indispensable as a vital element in our national defense. Imagine if you can the terrific handicap a nation with no or even strictly limited oil supplies would be under in these days if at war with a country which possessed adequate oil resources. Our air fleets would gather cobwebs in their hangars, our ships could not leave their ports, we would have no mechanized artillery or motorized transport. There might not even be sufficient lubricating oil for our horse-drawn caissons and the rifles of our infantry. So dependent for its very life is this country

HAROLD L. ICKES

upon oil that it is not taking an extreme position to say that the oil industry is peculiarly charged with a public interest. For this reason I have no hesitation in affirming that unless oil can regulate itself, at least to the point of preventing such waste as has gone on in the past, the Government will be justified in taking whatever steps may be necessary to regulate and preserve for use this essential resource.

This industry is intimately and inextricably interwoven with our whole social fabric. We must conserve carefully and use prudently the oil resources that we have. We must prevent further reckless exploitation and wanton waste. We must cease producing tomorrow's oil today.

Reckless and Improvident

Billions of feet of natural gas, spelling comfort and convenience and riches, have been allowed to escape into the air. We have permitted unscientific exploitation and overproduction, resulting in a too great supply of crude oil and gasoline in storage above ground. We have been guilty of reckless and improvident methods of capture. More oil has been produced than could find a legitimate market, with the result that prices have been forced to a point far below the cost of production. This oversupply of oil has gone to inferior uses and tended to disrupt the market for coal, with resultant disorganization and distress to both of these two great and essential industries. The greed of man for quick profits, without a thought for the welfare of the country or any concern for the future, has been defended not only by exploiters of this valuable natural resource but by a school of political thought which euphemistically applied the term "rugged individualism" to unpatriotic greed, ruthless waste and unparalleled selfishness. In our haste to take as much oil out of the ground as possible before other wells tapping the same pool or producing from other areas can be put on the market, we have not cared who was the hindmost for the devil to take. It has been said over the signatures of responsible students of the oil industry that as much as "80 and 90 per cent of the oil is lost and abandoned in the sands. Natural gas is blown into the air and the function of gas energy disregarded in the mad scramble for 'more oil now'."

Criminal Waste

As an example of this criminal waste, these same writers go on: "In Texas two wells on the top of a dome were allowed to blow dry gas in the hope that oil would eventually be drawn up. After blowing for 34 and 18 days, respectively, and expending approximately 250,000,000 feet, oil appeared; one well yielded 10 barrels a day, the other 26. Recently at Kettleman Hills in California a billion feet of gas a day, enough to supply the industrial needs of San Francisco and the whole northern part of the state, have been allowed to escape into the air."

It is probably true that every experienced oil man knows personally of similar instances either of deliberate wastage in the hope that oil might follow the gas or of the blowing into the air of gas produced along with the oil. So far as the situation in California is concerned, it is only fair to say that the condition of which the instance at Kettleman Hills has been quoted as a horrible example has been very much improved. Gas wastage in that state during 1932 was 93 per cent less than in 1929, the total loss having been reduced from seven hundred million feet per day to a mere 48,000,000 feet.

Nor is this all. Oil pools have not been properly tapped. There has been little concern as to the proper spacing of wells or their strategic location on the geologic structure in such a way as to utilize the pressures of gas and water to conserve both oil and gas and eliminate useless pumping costs. Moreover, instead of employing sound engineering methods to conserve the oil in its natural reservoirs underground, bringing up only so much as present demands require, millions of dollars have been spent in drilling and maintaining superfluous wells which have called for the building of expensive storage facilities above ground where the oil is exposed to losses through evaporation and occasional burning.

Unfortunate Repercussions

Such unregulated and, therefore, wasteful production, and such unrestrained competition as I have referred to, have, of course, had their unfortunate repercussions. It is just as true in the oil industry as it is true generally that "wilful waste makes woeful want." The wilful waste with respect to oil has resulted in the woeful want of the men whose livelihood and economic welfare depend upon an orderly and scientifically conducted oil business. If there have been flush periods of oil production at the wells followed by slack output at high costs, there have by the same token been seasons of quick and enormous profits followed by periods of heavy losses and of economic stress and strain. It might be hazarded as a guess that if the oil business from the beginning had been operated as a permanent, stable, and steady enterprise with less of the spirit of adventure in it; if we had been satisfied to produce from the wells only what could reasonably be consumed at a fair profit; if there had been less of the get-rich-quick spirit in the oil business and a greater willingness to build solidly and substantially for the future, we would perhaps not have had to go through such a distressful period as we have witnessed in the immediate past and from which, as I hope, we are now happily emerging with the help of the Federal Government.

Commercial production of crude oil began in the United States in 1859. From that beginning until the close of 1932 the recorded oil production of the United States totaled nearly 15,000,000,000 bbls., valued at the wells at approximately $19,000,000,000. The average value per barrel from 1859 to 1932 was $1.28. The price of crude has always fluctuated violently. Ten-cent crude such as we witnessed to our distress early this last summer was not a new thing in the oil industry. There had been other times in the past when competitive and unrestrained drilling following a new and large discovery of oil had resulted in such an increased supply as to force prices to low levels by the sheer weight of that supply.

Chiselers Break Through

There have been sporadic efforts, by voluntary agreement, to regulate the oil industry, only to be followed by periods when chiselers within the industry have broken through the regulations voluntarily assumed by themselves, resulting in a renewed rush to bring in new wells and to produce more oil from old wells, thus driving the scale of prices lower and lower.

As an illustration: By the summer of 1872 crude prices had fallen to such a point that producers believed the situation to be desperate. They got together and signed an agreement that for six months no new wells would be drilled. As this offered no immediate relief, a 30-day shut-down was proposed. The response was immediate and within a few days scarcely a barrel of oil was being produced. Then rumors began to circulate that the shut-down had been proposed by producers who already had their tanks full and wanted the wells shut in until they could sell their stored oil at a higher price. Some producers complained that since they had little oil stored, the closing down of their own wells would be only for the benefit of their competitors, while to shut them down was at the risk of ruining those wells. Shortly it was discovered that pumping was being done surreptitiously in remote regions during the night. Before the end of the month wells were being started all over the oil region in spite of the agreement. Then the report became current that some producers were selling directly to the refiners below the prices established by the agreement and it was not long before the refiners finally had to refuse to take any more oil at the fixed price. With crude prices dropping steadily many producers felt that their only recourse lay in getting as much oil as possible out of the ground and an era of feverish development followed. Crude prices dropped to 62 cents a barrel from the $5 a barrel that it had sold at just two years earlier.

Vital Factor in Defense

During the World War and for a few years thereafter there was a great scarcity of oil in the United States. It was during the war that the importance of this product as a vital factor in national defense was brought home to us in a manner that I hope will never be forgotten. Most of all you will remember the self-denial that our people willingly exercised in order to assure an adequate supply of

*Before A.P.I., Chicago, October 25.

gasoline for the allied armies in Europe. Self-imposed gasolineless Sundays were cheerfully observed. Shortly after the war there was a period of scarcity, particularly on the Pacific Coast. It is hard to realize that within the past 15 years automobile owners got up at the break of day to drive to a service station and there wait in line one or more hours for their daily ration of gasoline. On many occasions the supply was exhausted before all cars could be served. Yet such things happened on the Pacific Coast. Special tank trains of gasoline were rushed over the Rockies and keels were laid hurriedly for tank steamers intended to carry Mexican crude oil to California refineries. By one of those unexpected and romantic turns that so frequently happen in the oil business, these same tank steamers when put into service were used to transport California crude to the Eastern seaboard refineries and the Mexican fields, which were to furnish a supply to crudeless California, had little oil to spare.

Discovery of the Los Angeles Basin fields relieved that particular period of scarcity. Then followed a succession of major oil discoveries—Seminole, West Texas, Kettleman Hills, Oklahoma City, Hobbs and East Texas, and once again we were in a period of flush production. Moreover, concurrently with the bringing in of these huge oil pools, notable scientific advancements were made within the industry itself. More scientific and less wasteful methods of production and of handling oil were devised and put into effect. New cracking methods nearly doubled the amount of gasoline obtainable from a barrel of crude.

Average Value

The average value of crude oil per barrel from 1859 to 1932 was $1.28. Prices dropped to extreme lows during the summer of 1931. Overproduction of crude and undercutting of prices in the East Texas field tended to depress prices generally throughout the country, with the result that many of the so-called "marginal wells" were closed in. Improvement became possible when the East Texas and other flush fields were curtailed so that crude prices were uniformly higher throughout 1932 only to be followed by another decline during the last two weeks of that year. This was not halted until the middle of June, 1933, when East Texas crude was again near the 10-cent level and the national average was only slightly more than 30 cents a barrel. The slight improvement recorded in June held without much change until the latter part of August when a series of advances started which brought the national average crude oil price to the dollar level or slightly higher.

I had hardly been sworn into office as Secretary of the Interior before the critical situation with respect to the oil industry became a matter of concern to the administration, and President Roosevelt at a cabinet meeting instructed me to call the oil conference which was held in the Interior building during the latter days of last March. As a result of a three days' conference, in which the governors or their representatives from the oil-producing states and a representative cross-section of the entire oil industry participated, it became alarmingly clear that the situation in the oil industry was even more critical than the administration had thought it to be. The overwhelming sentiment of the representatives of the oil industry at the March conference was in favor of strict regulation and control of the industry by the Federal Government itself. It was openly avowed that conditions were such that the industry itself was not able to right itself without the strong hand of the Government.

Appeal to Congress

Following this conference a bill was drafted and introduced into congress giving to the Federal Government wide powers of control and regulation of the oil industry. This bill was an attempt to express in legislation the conclusions arrived at by the overmhelming majority of those who attended the oil conference. But by the time this bill reached congress there were prospects of a substantial business upturn, with the result that some of the oil interests which had favored strict government regulation and control, experienced a change of heart and opposed the bill. Having before it for consideration many pressing legislative measures, congress, in view of the divided sentiment that was found to exist in the oil industry, declined to enact the bill as presented but it did include among the general provisions of the National Industrial Recovery Act an important section relating to the oil industry.

Meantime the oil situation went from bad to worse. At the time of the March conference crude was selling at approximately 50 cents a barrel in the Mid-Continent field. Steadily it sank to still lower levels until in some instances in East Texas it was being bought at the ruinous price of 10 cents a barrel. The situation seemed little short of hopeless.

Fortunately, congress had granted in the National Industrial Recovery Act practically the same powers that has been set up in the prior oil bill that had failed of passage. Accordingly, steps were taken to draft a code for the oil industry and it was found as expected that the essential purposes and intent of the rejected oil bill could be set up in the code. But it was no easy matter to agree upon provisions that would meet with the general approval of those engaged in the oil business. The greatest difference of opinion was with relation to price fixing. A numerically and financially powerful group wanted to lodge in the Federal Government not only the power to regulate production but to fix maximum and minimum prices as well. An equally powerful group strenuously opposed inclusion of such a provision. In the end a price-fixing clause was introduced and generously, although perhaps reluctantly, accepted by those who had opposed lodging such an extraordinary power in the administration.

Administration of Code

Following the adoption of the code, the President did me the honor to appoint me oil administrator. Concurrently, in accordance with the provisions of the code, he set up a Planning and Co-ordinating committee that was fairly representative of the oil industry. Also, with the idea of clarifying and strengthening the code, he amended certain provisions thereof.

As oil administrator it seemed to me that my first and most pressing duty was to try to bring the supply of and the consumptive demand for crude oil at least within speaking distance of each other. No one would even attempt to argue that any practical regulation of the oil industry is possible unless supply and demand are equalized as closely as possible. If crude oil is thrown on the market in excess of demand, prices will fall and will keep falling in proportion to the amount of crude that is pressed upon the market beyond its consumptive demand. Price fixing, powerful and drastic remedy that it is, cannot serve to keep prices where they ought to be if production is permitted to be out of bounds. The history of the oil industry in this country proves beyond the peradventure of a doubt that we cannot hope for a price for oil that will yield a fair profit to the producer or even get him back his costs unless production is kept within proper limits and measured by consumption. All the king's horses and all the king's men cannot put this particular Humpty-Dumpty together again if there is a renewed period of unrestrained production of crude oil in this country.

Also True of Refining

And what I have said with respect to production, is equally true of refining. Our large stock of oil in storage is at one and the same time a great asset and a great liability. It is an asset in that it can provide needed flexibility in balancing production with consumer demand. It is a liability, for if it is used by refiners to increase unduly their gasoline inventories, such excessive inventories can break the market even though production and consumption are perfectly balanced. We cannot, by executive fiat, control price without controlling the things that control the price.

And so on September 8, 1933, the oil administrator promulgated an allocation of crude covering all the oil-producing states in the country. In announcing this allocation I was fully conscious that I was permitting for the time being a somewhat larger production of oil than the market could reasonably absorb. I felt it the part of wisdom, however, to err on the side of supposed consideration for the producer. I did not want the exercise of this new and drastic power of government to be too great a shock to him. I wanted him to realize that we intended to be reasonable and fair in our administration of the oil code. I felt that we would be running no great risk even if temporarily a slight excess of crude oil should be produced because the allocation could be changed at any time.

The result of the promulgation of this allocation was immediately beneficial to the oil industry. Prices went from 64 to 89 cents in the Mid-Continent Field and there was a distinctly improved tone throughout the industry. After giving full opportunity to the industry to judge of the reasonableness of the original order and to adjust itself to the reduced production, the oil administrator subsequently, on October 1, 1933, reduced the allocation to 2,338,500 bbls. after he had become thoroughly convinced that oil was being produced at too high a rate for the absorptive capacity of the market. This second allocation is still in effect but we are keeping constantly in touch with the situation and will be prepared, upon a proper showing of facts, to change it either up or down in our determination to balance production and consumption.

Some Cheating

I regret to say that in spite of the fair attitude of the Government with respect to production there has been some cheating. Production in some fields has not kept within the allowable, with the result that the overproduction of crude, resulting as it has in an oversupply of gasoline, has been a great weight on the market. In order to discourage further chiseling my second order covering permissible production of crude decreed that overproduction for any month would have to be made up by a compensatory smaller production the following month in order to bring the total for the entire period within the allowable. I am informed that there is still too much oil being produced and unless production is restricted to the figures permitted by my last order I intend to exercise the drastic powers given me by the oil code. If necessary I will invoke these extraordinary powers on November 1, next, and fair notice has been given to every producer of oil that the administration means business when it puts a limit upon the crude to be produced.

Before coming to the question of price fixing I want to refer briefly to that festering sore—hot oil. You, of course, do not need to be told what hot oil is but the public generally does not understand the term and so I will explain that hot oil is oil produced in violation of the laws of the state of its origin. This oil is in excess of the allowable. It is bootleg oil, surreptitiously put into the channels of trade. Its quantity can only be guessed at. Since it is illegal oil it is sold at distress prices and it has a particularly depressing effect upon the market.

Acting under the authority conferred by the National Industrial Recovery Act, even before the oil code was written, the President delegated to me the powers conferred upon him by that act to put a stop to this evil practice. Accordingly, on July 15, 1933, I issued orders and regulations for the purpose of stopping the production of hot oil. The effect was instantaneous and highly salutary. Within a short time there was practically no hot oil being run. Such violators as there were were brought up with a sharp turn and when those caught red-handed wanted to discuss settlement we took the position that the fine that we would accept must be the total profits made as the result of the running of the hot oil that had constituted the offense. This was done in the belief that if the production of hot oil was made profitless it would do more than anything else to put a stop to the practice. An attempt to enjoin the exercise of these powers was denied by the courts in the District of Columbia, and by the Federal District Court in Texas.

I regret to say that lately there has been a renewed attempt to produce hot oil and I assure you that we will diligently and assiduously keep after these renegades until we succeed in forcibly persuading them that the federal law is not lightly to be disregarded.

Price Fixing

I come now to the question of price fixing, in which all of you are particularly interested. It was first proposed that the oil administrator, simultaneously with his promulgation of the order allocating the production of crude oil, should put into effect a complete schedule of prices for crude oil and the products thereof. I felt that this would be moving too fast. I considered it the wiser course to try to bring production and consumption into balance before undertaking to fix prices. Nothing like it had ever been before attempted in the history of the country. The fixing of prices meant, in effect, that the Federal Government would be the final authority in this tremendous and important industry. Our decision might serve as a precedent for other industries. Such a course was not lightly to be entered into.

Pressure to fix prices not only continued but increased. I had a feeling at times that those advocating an immediate fixing of prices did not have a proper concern for the consumer whose interests it is the duty of the Government to protect. I was convinced that it would be a mistake to fix prices unless a proper basis of facts justifying each particular price item could be laid. It was necessary to know with reasonable accuracy costs of producing, refining and distributing before we could intelligently or legally fix the prices of any product or service in which those costs were a necessary or important element. Here was a question of major economic and political policy that had to be considered and decided wisely if we were not in the end to do more harm than good. The schedule of prices urged upon me by the Planning and Co-ordinating Committee was based upon the price of $1.11 a barrel for crude in the Mid-Continent Field.

Schedule Adopted

After most careful consideration and after a strong case had been made out for the necessity for price fixing, on October 16 I promulgated a price schedule to go into effect on December 1, next. This schedule is based upon $1.11 crude in the Mid-Continent Field and was prepared and presented to me by the Planning and Co-ordinating Committee with its favorable recommendation. I decided to adopt these figures as a basis for hearings and for independent investigations because I felt that I had the right to assume that this committee of informed and active oil executives was in a better position than was the oil administrator to work out a fair and equitable schedule of prices that would be for the best good of the greatest number of those engaged in the production, refining and distribution of petroleum and its products. But to guard against mistakes, it was set up in the order that hearings would be granted prior to December 1 to anyone in the oil industry who might have any objection either to the practical operation of the schedule as a whole or to specific prices declared in that schedule. We will hold hearings upon facts. We want to know what the facts are. We will be guided by the facts. If we are persuaded after studying the matter that the schedule as a whole or any item in it is not what it ought to be, it will be amended accordingly and then the schedule, as and if amended as a result of these hearings, will go into effect on December 1, next,

(Continued on Page 99)

Work of Planning and Co-ordinating Committee Is Explained by Chairman Wirt Franklin

By WIRT FRANKLIN
Chairman of the Planning and Co-ordinating Committee*

The American petroleum industry stood on the brink of ruin when 1933 dawned. Everywhere was demoralization. An oversupply of crude petroleum, a diminishing market demand, a rapidly increasing tax bill, destructive warfare in competitive marketing, reduced stock values, increasing losses often wiping away the earnings of a lifetime, receiverships and imminent bankruptcies: these made up the common outlook of our industry when this year opened. Increasing discontent, aggravated suspicions, waning faith and vanishing hope characterized the general attitude.

All this is behind us. It is useless now to attempt to fix any blame or responsibility for these conditions. This is no time, either, to arraign or suspect or condemn the guilty. Instead, we face the challenge and the responsibility of the new deal. Today for the first time in history, after years of strife, all factions in the one phase of our American industrial life which has been most distinguished for its individualism, are endeavoring harmoniously to work out a program of co-operation, with just regard for the rights of all, with a fair opportunity for the small as well as the great, and with a care for the future as well as for the immediate present.

Well-meaning men, with the best of intentions, had hitherto been prevented from coming to any common agreement by which the glaring evils of the oil industry might be corrected and a sound basis provided for its continued prosperity. Few desired the repeal of the anti-trust laws which were considered the principal line of defense of the smaller companies or individuals against their larger competitors. Even where the law did not forbid, the stress of competition and the struggle to survive made it difficult to secure any co-operative action which might involve even temporary sacrifices of immediate profit on the part of any group. In brief, the industry had never evolved a method by which it might sit down around a table, talk over its problems and determine what was the right thing, instead of the selfishly profitable thing, to do for the well-being of the industry as a whole.

None Exempt From Loss

We have all suffered in the past. Even the few who may believe that they gained some temporary advantage at the expense of others in the industry are now coming to realize that they, too, have lost and that any accurate balance sheet or cost accounting system would prove that they have not been exempt from sharing with the rest the heavy losses which brought the industry to the verge of ruin.

Wasteful production, breaking the market, compelling the closing of many wells which might have continued to add to the nation's wealth, prematurely exhausting an irreplaceable and valuable natural resource, has been one of the industry's most serious problems. A flood of imports, either actual or threatened, increasing whenever it looked as though a fair price might be obtained for American petroleum and its products, contributed to prevent the erection of any stable price structure. The breakdown of the proration system through the production of hot oil weakened the morale of many who were hoping for some stabilization of supply and lessened that regard for law and order upon which civilization itself depends. Price wars, starting when some individual or some company hoped to gain an increased gallonage through the sacrifice of a fraction of a cent, have raged over large extents of territory again and again, draining the financial reserves of many who could ill afford these losses but who were forced to meet the price posted by their competitors or withdraw from the contest.

These are just a few of the many ills which have afflicted this industry. There was neither reason nor excuse for any of these. The demand for our products has not decreased in the same ratio as the demand for all other products in common use throughout this country. In fact, consumption of petroleum products continued to increase until 1932. Every economic reason existed for the comparative prosperity of our industry even through the years of depression. We had no labor troubles to annoy us. Our difficulties and our troubles were largely the creation, now of this group and now of that one, seeking to gain an immediate and selfish advantage in the sternly competitive race forced upon us by circumstances which we could not control, unless some common ground of agreement and co-operative effort were reached.

Earnest Efforts

Many earnest and sincere efforts have been made to solve these problems. One of the most recent of those efforts came in March of the present year, when a three-fold conference of the various elements in the petroleum industry and the governors of the oil states was held under the auspices of the Secretary of the Interior, Harold L. Ickes, when plans were made to save the industry from that complete demoralization which then seemed inevitable. The program adopted at that conference was presented to the new Congress in various bills. One of these measures, the Federal oil control bill, embraced limitation of imports, establishment of quotas for production and storage withdrawals, denial of interstate commerce rights to illegally produced oil, allocation of market demand to current production, imports, and storage withdrawals and allotments to the several oil states and the pools and areas in such states, including purchaser allocation, and authority for the Secretary of the Interior to take steps to establish reasonable and suitable rates for the transportation and storage of petroleum and its products.

Repeated amendments to this bill and the later substitution of a measure drafted by the Interior Department and presented as an administration proposal, although without the active support of the administration, brought before Congress and the United States at large the importance of affording immediate relief to an industry ranked by the Secretary of the Interior as the second in the country and probably directly affecting more people than any other.

Special Action Needed

Pressure for adoption of the National Industrial Recovery Act interfered with the passage of this special measure intended to provide for the peculiar needs of the petroleum industry. For a time it appeared highly probable that this industry, whose problems are unlike those of any other, would merely be one of the hundreds which would come under the control of the administrator of the National Industrial Recovery Act. Many of us believed that administration of our industry, under the governmental system that was being developed, would follow the standardized form which might meet the needs of manufacturers, jobbers and retailers of boots and shoes or pressed bricks. Unfortunately, our problems could not be solved by any standardized process or formula. They required expert superintendence.

Our production was not like the production of a factory. It was not even like the production of a coal mine or other natural resource. A system which might adequately cover factory production or ordinary mining production would never fit the production riddles which have proved so puzzling to the oil industry. Our distribution problems were unlike the problems which confront either the jobber or the retailer of any of the other staples of American life. In brief, the National Industrial Recovery Administration, which had worked out practical formulas fitting the needs of ordinary industry and commerce, seemed, to many of us, not equipped to meet the unique and baffling problems upon the careful and proper solution of which depended the recovery of the American petroleum industry and, with that industry, the full recovery of our national equilibrium.

Full Expression of Opinion

When the code of fair competition for the petroleum industry was presented, the fullest opportunity was given every element in the industry, regardless of its size or its importance, to set forth at length its proposals. The record of those hearings is one of the most illuminating and important in the history of the industry. All the causes of conflict, all those divergent points of view, all those

*Before A.P.I., Chicago, October 25.

California and New Jersey Negotiations Are Officially Announced at End

By C. O. WILLSON
New York Bureau, The Oil and Gas Journal

NEW YORK, Oct. 23.—Following the official announcement that the merger plans of the Standard Oil Co. of New Jersey and the Standard Oil Co. of California had been definitely ended, there was considerable speculation in local oil and financial circles as to the probable future expansion plans of the New Jersey company. No explanation as to why the three-year negotiations of the two companies were ended but it is assumed by many that the New Jersey company will continue plans to widen its domestic operations with the view of securing a national distribution of its products.

In some quarters it is stated that the merger plans were ended due to the attitude of the present national administration. Other reports state that the plans were dropped because of differences in opinion regarding operating policies. The basis for this assumption apparently lies in the fact that in the present controversy within the oil industry regarding the desirability of price control, the two companies are on opposite sides of the fence. The California Standard as represented by its president, K. R. Kingsbury, has favored price control from the time the various hearings started in Washington, D. C., last spring. As a member of the Planning and Co-ordinating Committee at Washington he is given major credit for bringing about the acceptance of its price control program by the Government this week. At the same time the New Jersey Standard has not altered its previously announced opposition to all price control plans by the Government.

Local observers are more concerned with the probable operating plans of the two companies than they are the causes that brought the ending of the merger plans. As originally conceived it was believed that the companies concerned had in mind the reuniting of other Standard units. It was pointed out at the time the Standard of New Jersey and California negotiations started that the addition of the Standard of Indiana and Standard of Ohio would give the Standard organization a national distribution which no single company has at this time. Various developments within the several companies were interpreted as pointing to this objective.

Assuming that merger plans will not be resumed later, it is believed that the New Jersey company and possibly one or more of the Standard companies will expand their operations with the view of getting away from their present sectional operations. In the case of the New Jersey company, distribution of its domestic subsidiaries, including Colonial Beacon Oil Co., Standard Oil Co. of New Jersey (operating unit), Standard Oil Co. of Louisiana and Humble Oil & Refining Co., is being handled by a subsidiary called the Esso Stations, Inc. In June the companies started the distribution of a regular grade gasoline under the name of Essolene. Recently the Esso Stations, Inc., has taken out charters in states in which at present the New Jersey company does not have distribution.

It is pointed out that through the marketing unit the company could expand its operations throughout the entire country and not overlap in trade names with other standard companies. No official confirmation of a such a plan has been given. Financial observers, however, have long pointed out that the national expansion of the individual Standard units was inevitable in the event that it is not feasible to merge their operations The domestic expansion of the Pan American Petroleum & Transport Co., a subsidiary of the Standard Oil Co. of Indiana, is also pointed to in discussions of this nature. Although the Pan American disposed of all its foreign holdings to the Standard of New Jersey last year, it is at this time expanding its domestic operations, including the construction of a major refinery at the Gulf Coast.

As having some bearing on future plans, the recent foreign expansion of the Standard Oil Co. of New Jersey also is stressed. The latter company purchased the stock of the Union Oil Co. in Atlantic Union Oil Co., Ltd., a company formed several years ago by the Union and the Atlantic Refining Co. to carry on marketing operations in the Far East. Last month it was announced that plans had been completed for the joint ownership and operation of an integrated Far East company by the New Jersey Standard and the Soconoy-Vacuum Corp. This territory in the past has been an important foreign outlet for the Standard Oil Co. of California.

hotly contested theories of the various schools of thought, are set forth in that record. For a time it looked as if some might be "heard for their much speaking," and that the radical and the revolutionary in the petroleum industry might overwhelm those who were endeavoring to build constructively.

The code as ultimately approved by the President of the United States and submitted to the industry was admittedly imperfect. It was an attempt to compromise. That attempt was made, in a large part, by men who were not fully conversant with the very issues which they were attempting to compose. The President's letter of approval of August 19, 1933, clearly recognized the code's imperfections and stated his purpose to amend the same, a purpose which he fulfilled, at least in part, last month.

The plan to establish a self-governing industry under Federal supervision, to borrow the phrase used by President Roosevelt in his letter of approval, included the selection of a representative Planning and Co-ordinating Committee of the industry. That committee was selected by the President from nominations sent to him by any groups which desired to present their suggestions for his approval. On that committee probably every phase of the industry is represented. The great companies and the small ones, the majors and the independents, the flush producers and the stripper wells, the refiners, the marketers, integrated and independent, the great geographical divisions of the industry, each has its spokesman on that committee.

Great National Problem

The Planning and Co-ordinating Committee, while containing representatives of every phase of the industry, does not represent any faction or any geographical section or any economic division in the industry. It represents the industry itself. The so-called major and the so-called independent, sitting side by side on that committee, forgets that one is a major and one an independent, forgets even the business policies of the company with which he may have long been associated, and looking at the great national problem now for the first time spread in its completeness before a single group, seeks to find the answer. Never before have any dozen men had set before them with the fullest detail the tremendous problems of this industry as a unit. Each of us has seen our own difficulty. All of us have known just where the shoe pinched us personally, but now for the first time in the history of the petroleum industry, fair-minded men, representing the best thought and the most accurate information available, are attempting a diagnosis of the ills of the entire industry with the view of healing them.

We now know that this great industry cannot hope to function properly while rival factions war upon each other. "We are members one of another." Either the whole body of the oil industry will be healthy and sound or else the whole body of the oil industry will be diseased. Only parasites can thrive upon a dying organism. The parasites who have fattened in the past upon the misfortunes of this basic business are being swiftly eliminated while the honest producer, refiner and marketer presents by united effort the constructive program of the New Deal.

No 12 men, even with the assistance of three representatives of the Federal Government, would ever attempt to handle all the problems and all the detail involving so tremendous an organization as the petroleum industry. The Planning and Co-ordinating Committee now has far more than a thousand representatives throughout the country. It has selected regional committees and state committees which are fully representative of the whole industry. On those committees today there are men who had long fought each other conscientiously and determinedly. Men who never agreed on anything but who held their disagreement as a matter of principle, are now sitting in city after city all over this country, trying to work out some way in which those differences might be resolved and the fullest fairness developed for the industry as a whole. It is a new game of give and take with all sides giving and no side seeking to take more than its equitable and just due.

Many Problems to Solve

I do not mean to say that the millenium has arrived in the petroleum industry; but compared with the internecine strife that marked our history for many, many years, this is the Golden Age. It is, however, only a golden age of opportunity. We have many problems yet to solve. But we do believe that, under the code of fair competition, we have the finest and the greatest opportunity ever given this industry to clearly state those problems and then to work out a practical plan for their ultimate solution.

For too long the industry has thought merely in terms of barrels and gallons. One of the first difficulties that is being faced today, in all these committees, is the problem of getting men to think not only in terms of barrels or gallons, whether it be production, refining or marketing, but in terms of dollars. The petroleum industry has been on the bargain counter for so long that it has not even today adjusted its thinking to terms of profit and loss. It has used red ink for so long that it seems to have forgotten that there can be a use for any other color on its ledgers. The essence of the code of fair competition—as of the NRA itself—is the prevention of sales below cost. No industry can permanently endure when its products are sold below cost. Unfortunately the petroleum industry has for so many years operated on a wartime basis that it is not prepared to immediately return to a peaceful schedule in which the cost of operation and of selling are given their due consideration. That some in the petroleum industry have no conception of what their actual costs really are was made painfully evident by some of the statements made at the hearings on the several codes proposed.

Allocations First Step

Inevitably the first significant step taken by the Planning and Co-ordinating Committee was the recommendation of allocations to be made by the oil administrator which would reduce our production to some rational limits. This attempt to balance supply and demand is, necessarily, fundamental to any effort to stabilize the industry. That point has repeatedly been emphasized. Coincident with that limitation of production was the parallel limitation of imports and the administrative order forbidding withdrawals from storage except under special permission. The response to the allocation orders which have been issued was immediate. While the price advances made did not fully meet the amount necessary for full cost recovery in many fields, they did mark a great advance over the ruinous prices, sometimes reaching as low as 10 cents per barrel, which had paved the way for bankruptcy or utter ruin for many in the industry.

The necessity for production limitation and the value of making allocations on a national basis having regard to the total consumptive demand of the nation will become more and more apparent as time goes on. Inevitably the first orders issued were experimental. Because of the failure to perfectly enforce the proration programs in the states which had proration laws, and also because no complete statistics were available showing the amount of oil actually in storage or withdrawn from time to time and, further, because no one really knew just what was the consumptive demand throughout the entire nation, it was impossible to make the first orders establishing state quotas for production as scientifically accurate as might be desired. The quotas established in the first order were readjusted in the second. Additional readjustments will probably be necessary. The fact that in the various oil states there exist different standards by which the potential production is estimated, still further complicates this task. Then, too, there enters into any question of allocation the element of natural markets, established trade customs, historic relationships, and a multitude of other incidental factors, such as the maintenance and preservation of stripper well production, further complicated by the necessity of ensuring a proper supply to refiners sometimes located at a distance from the field and by peculiar transportation problems.

Best Practical Plan

It is improbable that any one will seek to defend the present allocation orders as being absolutely perfect. They do, however, represent the best practical plan which could be devised by fair-minded men eager to obtain the fullest and best information available, looking to the needs of the industry as a whole and forgetting, while they sat as judges or jury, their own personal advantage or that of the corporation to which they had given most of their lives.

It is inevitable that any allocations whatever would fail to satisfy one section or another. The status which prevailed when the Planning and Co-ordinating Committee began its work is likely to be assumed as the proper condition by those districts which then had large production. Other sections, where production had been shut in, would naturally feel that they should not be penalized for their past and present sacrificial attempts to stabilize the industry. Furthermore, the stripper well group constituted a difficult problem. It is not fair to prorate these stripper wells and it should not be done. The flush pools responsible for oversupply should be compelled to take the burden of curtailment. It is equally hard to prorate fields or pools whose potentiality has never been accurately gauged, although it is recognized as being enormous.

Each attempt to readjust the original proration schedules, issued by the Federal oil administrator, has the unfortunate result of making those whose production is decreased feel that something is being taken from them, without proper consideration. As rapidly as a reliable body of statistical data may be acquired, more exact justice will be done in the allocations, so far as the Planning and Co-ordinating Committee is concerned. Meanwhile, even the reduced production in any state where the new system has meant a cut will bring in larger returns in terms of dollars and cents than the often wide-open production in some areas which preceded this attempt to stabilize the industry.

Limitation of Imports

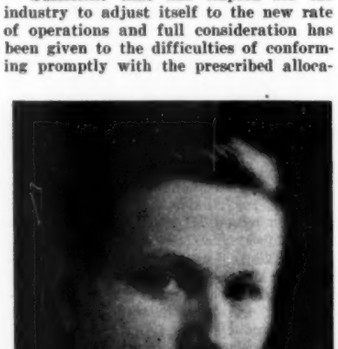
The limitation of imports was a necessary complement of the limitation of production. The scale established was that which had previously been accepted, vol-

(Continued on Page 92)

Oil Administrator Ickes Issues Orders on Production and Stock Figures

WASHINGTON, D. C., Oct. 23.—Secretary Ickes, oil administrator, announced that "immediate steps will be taken to adjust current crude oil production to the allowables effective September 8 and October 1.

"Sufficient time has elapsed for the industry to adjust itself to the new rate of operations and full consideration has been given to the difficulties of conforming promptly with the prescribed allocations. A proper balance of supply and demand is essential to stabilization of the petroleum industry under the code. The industry and the public expect production allowables to be rigidly enforced, and I shall take every step necessary to that end.



H. J. STRUTH

Who has been named Technical Adviser, Petroleum Administrative Board

"I am confident that a vast majority of the units in the industry, as well as all state regulatory bodies, will co-operate fully in this effort. To prevent a disruption of the program by a small majority, the announcement is made now that on November 1, 1933, the authority vested in me by Article 3, Sections 3 and 4, of the petroleum code to curtail shipments in interstate commerce will be exercised with respect to such states as have not cut actual production since September 8 down to the permissible quotas.

"I should regret the necessity for taking this step, but I deem it essential to preserve the stability of the industry as a whole, and to safeguard the rights of those states and those producers who have complied with the allocations. The several state regulatory bodies that assign quotas to the respective fields, leases, and companies, have the power to control offending units. I hope they will take immediate action against those who are producing in excess of their legal quotas, in order to prevent production from exceeding the state quotas."

Mr. Ickes dispatched telegrams to the Railroad Commission of Texas, the Kansas Corporation Commission, and the Corporation Commission of Oklahoma, notifying them of excess production in their several states and giving notice that the drastic powers of the oil code will be exercised on November 1 if production is not curtailed to the quotas allowed.

The Texas Railroad Commission issued orders making the allowable of Texas at a figure slightly less than the total assigned to the state by Secretary Ickes under the Federal order. The total allowable fixed is 957,555 bbls. daily, compared with the 965,000 barrels allowed.

Crude Stocks

Secretary Ickes also announced figures on crude petroleum stocks at the close of the weeks ended October 7 and October 14 submitted by companies reporting under the Administrator's Order of September 29.

It is estimated by the Bureau of Mines, which tabulated the reports, that approximately 99 per cent of all crude oil stocks held in the United States, except lease stocks east of California, is included in the reports submitted.

During the period from August 31 to October 7, the reporting companies recorded an increase in storage of domestic crude oil amounting to 4,874,000 bbls., while stocks of foreign crude held in the

(Continued on Page 48)

Survey of Advances Made in the Maintenance and Repair of Crude Oil Pipe Line Systems

By WILLIAM G. HELTZEL
General Superintendent, Stanolind Pipe Line Co.*

1. The oil pipe line system of the United States, which serves every practical source of crude oil supply, is a vast underground system of 116,000 miles of trunk and gathering oil lines which extends itself from even the most remote and isolated sources of oil production, to the Gulf of Mexico, the Great Lakes, from the Rocky Mountains to the Atlantic Seaboard, with a group of lines leading to and skirting the coast of California.

The gathering systems, which in themselves are composed of 56,000 miles of lines varying in sizes from 2 to 12 inches in diameter, stretch out as feeder lines from focal trunk line points in a far-flung fashion to gather oil in large and small quantities from the remote and scattered oil fields.

2. The route of the pipe line is a direct and unswerving course, which each of the various individual trunk line systems, either as a single or multiple group of lines, takes in its route across country. In these systems there are 60,000 miles of pipe varying in size from 6 to 12 inches in diameter. Such lines may veer from their direct course to skirt the boundaries of towns and cities, but physical barriers do not alter their course materially. It is a direct route across country, regardless of whether it is over the somewhat arid plain lands of West Texas and New Mexico, or along the prairies of the Southwest, across the swamps and bayous of Louisiana and the Gulf Coast, over the wooded hills and through the fertile valleys of farm lands in Missouri and Iowa, under the productive farm lands of Illinois, Indiana and Ohio, over the mountains of Pennsylvania, and on to the Atlantic Seaboard. All the way from the Susquehanna in Pennsylvania, these trunk lines traverse in their long routes to the oil fields such rivers as the Alleghany, the Monongahela, the Wabash, the Kankakee, the Illinois, the Mississippi, the treacherous Missouri, the Arkansas, the South Canadian, and the well-known Red River. The road beds of the extensive system of railroads and highways are bored, cased, and crossed. Canals, ship channels, and city streets constitute a few of the other obstacles in the course of a pipe line to the refineries or seaports. Through the active trunk line systems, there moves a continuous stream of petroleum, under high pressure, 24 hours each day, and almost every day of the year.

The History

3. A very small part of this vast system of trunk lines was laid as long as 40 years ago; an appreciable part of it was put in the ground 30 years ago; but the greater portion of it has been built since 1912. I have not been able to obtain the necessary statistical data to figure an accurate weighted average of years the entire system has been in the ground and in service, but it has been estimated that such a weighted average for the whole system would be less than 17 years. It should be kept in mind that a greater part of this underground system is comparatively new, and the maintenance of it in the future must not be estimated by the experience of the past years.

Development in Pipe Line Construction

4. Previous to 1905, 6 and 8-inch lapweld, thread, and coupling pipe, in 20-foot lengths, was used almost exclusively in pipe line construction; consequently, that part of the pipe line systems built before that year consists of 6 or 8-inch lapweld, thread and coupling pipe. It was customary to use 8-inch pipe on the high pressure end of trunk line loops with 10 and 12-inch on the low pressure ends. The use of the 12-inch pipe was limited to the low pressure end of the

Fig. 1

line because 12-inch lapweld pipe did not permit operating at 600 to 700 pounds per square inch. This practice continued until about 1928 when the first seamless pipe of higher tensile strength came into a limited use. The higher tensile strength could not be obtained in lapweld pipe, because a high carbon steel could not be welded satisfactorily in the mill operation. However, the use of seamless pipe of higher tensile strength made it possible to use 12-inch pipe for high pressure service also. Until recently only a limited supply of seamless pipe was available for pipe line construction and, consequently, most pipe lines built previous to 1931 made use of lapweld pipe; the Pasotex 8-inch line was an exception. Only seamless pipe is used now for trunk line construction.

The period between 1926 and 1928 marked the beginning of new practices in not only the construction of pipe lines, but also their maintenance. The oxyacetylene welding of pipe line joints instead of the thread and couplings, and seamless pipe in longer lengths and of higher tensile strength instead of the lapweld joint of lower tensile strength, came into general use. The electrical fusion welded pipe in 40-foot lengths and with thin walls came into use about the same time.

Four to five years of practical operation has proved the reliability of the welded joint, and of course, the seamless and electrically welded pipe has proved thoroughly satisfactory; however, there is only a small part of these older trunk line systems of welded or seamless pipe with welded girth joints. Lapweld pipe in itself is not considered a serious disadvantage in a trunk line system; but the thread and coupling line requires constant maintenance and is considered obsolete and an economic handicap in the operation of the older trunk line systems. There are a few individual trunk lines of all welded construction, which, because of their very low maintenance cost, have been an economic and competitive challenge to the older systems with thread and coupling lines. This challenge will probably be met with developments in the offing.

The Human Side of Pipelining

5. You have been told something concerning the history of these pipe line systems, their age, the kind of material used, the sizes of pipe, the type of joints and some other technical details pertaining to the construction. The route of a pipe line across country has also been described in some detail, but the groundwork of this discourse would not be complete without some reference to the human side of our problems.

If a failure occurs in one of the trunk pipe line systems, it matters not whether it is in some remote area, with few or no good roads leading to it; there is no question about the weather; it matters not if such a failure occurs during broad daylight, the late hours of night, or in the early morning, the pipe line operating forces are called upon to make immediate investigation and the earliest possible repair. A failure in these trunk line systems which traverse the country, skirt the boundaries of cities, pass under rivers, and through rich farm lands, requires attention. Property must be protected, farm lands must not be damaged, streams must not be polluted, the lives of people must not be hazarded. The oil must be saved and operations must not be delayed.

Many times pipe line walkers have started across country in the darkness of an inclement night to follow the treacherous route of the pipe line to find and report on a leak or break which has been indicated by the stream checking short, or a drop in pressure at the pumping station. Regardless of the time of day; out into the rain, sleet or snow; through mud and mire; over frozen ground covered with sleet and ice and the countryside drifted with snow; far off the highways and the byways the pipeliners must go to do the emergency jobs. These men have worked knee deep in mud, and in water and oil to their necks; they have worked long hours on emergency jobs without food or sleep. Lines must be repaired in rivers, sometimes under 6 feet of silt and 30 feet of water. None of these conditions can deter or change the viewpoint of the pipeliner. We have been accused, as pipeliners, of having a strong back and a weak mind; pipeliners have been charged with many other things and called by many names and, commonly enough, among ourselves—but this much can be said for them—that they are a virile, loyal and courageous group of men, who, with a task assigned, will always see it through.

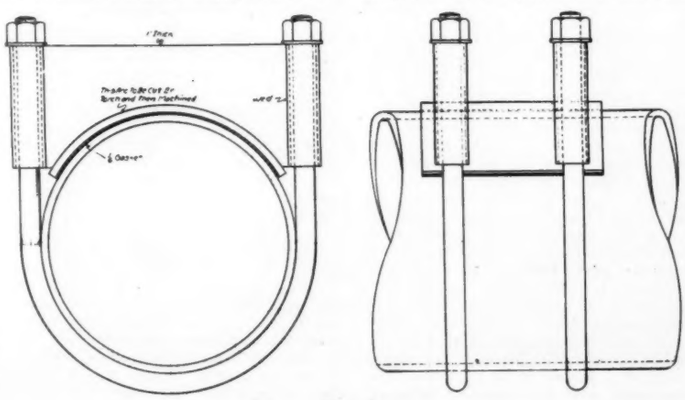


Fig. 2

To the Pipeliners of Bygone Days

6. In the bygone days when there were no concrete or graveled roads and very few good country roads to follow the course of the pipe line, and when there were no trucks or tractors, and the pipe line equipment consisted principally of the team and wagon, the mope pole and windlass, the pick and shovel, a heavy saddle clamp, the flange, the stock and die, and the right and left nipple, not only the workmen but their supervisors endured physical and mental ordeals—a test that only the brawn and the brain of pioneering men can withstand. The hardships that these men endured will remain a lasting tribute to the men who pioneered the oil pipe line industry and made possible and practicable the transportation of petroleum by pipe line.

Although the duties of the operating forces of a pipe line system, even in these modern times, are somewhat arduous and difficult, our hardships compare in no way with those who have gone on before in the pioneering of this industry and, in passing, I wish to take the privilege of paying tribute to that courageous group of men who have pioneered in the pipe line industry from the early nineties until a recent date. Some of the old school of pipe liners remain, but many of them have yielded their places to a younger group, as must of necessity occur in any industry. Their continued influence and guidance of the younger group, I am sure, is deeply appreciated.

The Influence of the Corrosion Committee of the American Petroleum Institute

7. Two phases of the discussion pertaining to this subject have been recognized. The one, a descriptive discourse of the history of pipe line systems, their age, what constitutes these lines, where they go, of what material they are built and under what conditions they are maintained—all as an explanation preliminary to the more practical and technical details of the maintenance of pipe lines, which follow as a sequence in the second phase of this paper. It is hoped that the first part of this monograph has been clear and complete enough to permit those who do not have a daily contact with pipe line operations, to follow with interest the remaining part of this paper.

Before passing to a discussion of the

*Before A.P.I., Chicago, October 26. Author's title "Advances in Maintenance and Repair of Pipe Lines."

practical problems in the maintenance of pipe lines, reference should be made to the fact that during the years 1926-1928, the work of the Corrosion Committee of the American Petroleum Institute was being organized. The diligent and persevering efforts of that committee have had an important influence not only on the development of better practices in the maintenance of oil pipe lines and the application of coatings, but have added valuable data to our knowledge of corrosion of underground lines. This group has been directly responsible for the pipe line industry abandoning the uneconomical practices of reconditioning

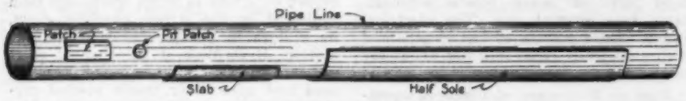


Fig. 3

the entire length of thread and coupling lines and brought about the "marking-time" during the last three or four years, awaiting a better knowledge of the corrosion problem, the development of better equipment, improvements of methods, the training of workmen and the selection of coatings—much of this program has been accomplished with tangible benefits to the oil pipe line industry. There remains much to be done and the work of this committee deserves the encouragement and support of the industry.

Maintenance Causes Have Remained the Same

8. The causes for the maintenance of oil pipe lines are fundamentally the same today as they were soon after the first pipe lines were built. There is the exception that the new lines constructed of seamless, electric welded or lapweld pipe with welded girth joints require very little maintenance; however, the older systems require not only the current maintenance on account of leaking couplings and corrosion, but also removing from the older lines, leaking companion flanges, stuffing boxes, collar leak clamps, saddle clamps, leak clamps, caulked couplings, defective right and left nipples, etc., which were used from time to time to make temporary repairs and have accumulated during the history of the line. Such materials served the purpose of making temporary or emergency repairs; but although these devices proved expedient, they continued to leak from time to time and their removal becomes necessary eventually, and especially since there are ways and means at present to make permanent repairs or replacements. This accumulation of repairs is no reflection on the men who have supervised and managed pipe lines in the past and it must be remembered also that the arts of an industry are accumulative and are developed largely by experience.

Radical Changes Have Occurred in Facilities and Equipment for Maintenance

9. Although the character of the problems of maintaining oil pipe lines has not changed materially, the means for doing the work have been revolutionized by such factors as:

(a) Building of concrete, gravel and improved earthen highways,
(b) Trucks and tractors,
(c) Oxyacetylene and electric welding,
(d) Improved tools and equipment,
(e) Better knowledge of corrosion,

all of which has not only facilitated and expedited the maintenance work, but has also brought about more economical operations and made it possible to effect permanent repairs.

Fundamental Maintenance Problems

10. Regardless of the type of construction in an oil pipe line, whether it be of the old thread and coupling line and lapweld pipe or of seamless pipe with welded girth joints, there are, common to all these lines, such routine maintenance factors as, the change of construction for new roads or other improvements necessitating the moving of lines; the lowering of lines on account of the erosion of soil and the tilling of farm lands, grading of roads, terracing of farm lands; the loss of line by floods in creeks or rivers, or by landslides; the failures of lines in creeks or rivers as a result of corrosion, the washing of ditches, etc. Because these factors are either of such routine character to be commonly known, or involve a discussion of such extent as to require an individual treatise, they will not be discussed in this paper. There may be an appreciable number of other miscellaneous factors of small consequence; but the following discussion will be confined to such factors as:

(a) Corrosion of underground lines.
(b) Leaking couplings.
(c) Pulling of couplings.
(d) Split joints.
(e) Cracked welds.

The Use of Electric Welding

11. The advent of electric welding for pipe lines about four years ago, resulted in a radical change in methods of repairing oil pipe lines. This reference is made before going to the discussion of detailed repairs, because there will be occasion to refer frequently to electric welding. Although oxyacetylene welding has been used for some time in the industry, it was not adapted to making repairs or welding against the walls of a pipe which was carrying a moving stream of oil, or in which the oil was standing still and consequently, electric welding became a very useful art for welding leaking couplings, welding patches to the line, encasing leaking couplings and lines with sleeves and depositing metal in the corrosion pits. Electric welding came into use at a time when the industry had decided to abandon the practice of reconditioning lines over their entire length and confine their efforts to the repair or coating of lines in the places which were known to be corrosive. The uncertainty over the corrosion problem, the effectiveness of coatings, undeveloped methods and equipment, brought about the "marking-time" in the industry.

This development, along with the study and influence of the corrosion committee, effected an abandonment of the practice of removing from the ground long and continuous lengths of operating pipe lines, placing them on skids over the ditch, cleaning them and applying a coating, until such a time as better coating materials could be provided; the men trained to better workmanship; more knowledge obtained concerning corrosion; the adequacy and effectiveness of coatings were determined; better methods of application were developed; and the necessary equipment for carrying out this work under all conditions was provided. The maintenance of pipe lines, as far as corrosion is concerned, has been passing through a transitory period awaiting the development of the factors which have been enumerated above. This program of repairing lines only in the "hot spots," a term which is generally known in the industry as an area which is subject to active corrosion and where the pipe has deteriorated, is still in effect. In brief, this maintenance program has been one of patching rather than replacing pipe.

Corrosion

12. There are many unexplained causes for the corrosion of underground steel oil trunk lines, because there are so many factors involved, especially in lines that traverse such lengths and encounter all kinds of conditions along their route. Practical pipe line men recognize some of the following general causes of the corrosion of these underground lines:

(a) Various types and degrees of subsurface soil corrosion.
(b) Stray electrical currents.
(c) Miscellaneous conditions on the pipe line right of way along its route.
(d) Oil leaks.

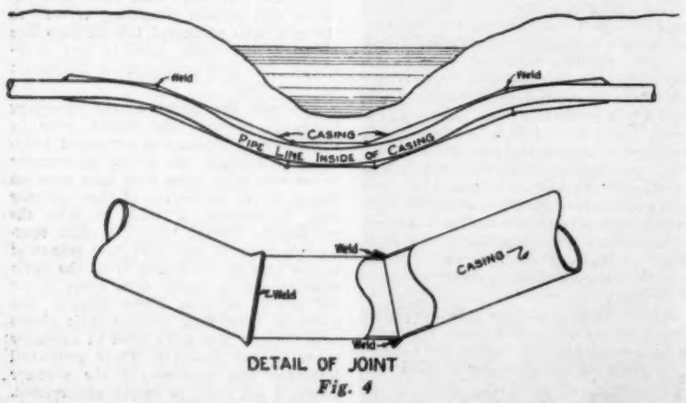


Fig. 4

Repair of Pit Leaks

13. It is general knowledge that if a piece of unprotected steel is buried in the ground it will deteriorate and perchance there are any corrosive elements such as cinders in the soil, an accelerated deterioration will occur. The same thing happens in the steel of a pipe line except that instead of the surface wasting evenly over its whole surface, the corrosion usually concentrates itself in small areas which results in "pits" that in time become sufficiently deep to penetrate through the wall of the pipe and an oil leak occurs. Fortunately, many of the holes at the base of the pit are not large, however, the oil loss and damage resulting from a single pit is appreciable. Corrosion ranks first, not only in cost, but also in the time required to maintain lines. Figure No. 1 shows the characteristic corrosion of underground lines.

When a failure occurs in the pipe line as a result of corrosion, which means a pit through the pipe, it is found by the line walker who covers the line on a regular schedule, by a drop in pressure at the pumping station, or by the volume of oil checking short at the next receiving station. There are occasions when the leak on the line is rather small and, consequently, a drop in pressure will not result, and it cannot be found in the volume of oil, but over a period of time an appreciable amount of oil can be lost; only the line walker can find such leaks.

Until recently, perhaps in the last four years, it was customary to repair such leaks by putting on a heavy cast iron saddle (Figure 2) with a gasket over the pit in the pipe; and if the pipe was badly deteriorated it was the usual practice to cut the pipe out of the line in due time. A temporary repair was always made, of course, with the saddle clamp until such a time as the line could be prepared for draining and replacement of the pipe. In more recent years, the practice of repairing corroded pipe pits has changed, and the usual procedure for the repairing of a small pit is to drive a wooden plug in it to prevent the leakage of oil, and then placing over it a small steel patch clamped to the pipe with a gasket between the pipe and the clamp. The installation of such a patch can be done by one man. This is considered also a temporary job but, in due time, the patch is electrically welded to the line, provided the pipe surface surrounding the pit will permit of welding, and the pipe itself will not have to be replaced. This is the first example of the valuable use of electrical welding in combating the corrosion problem.

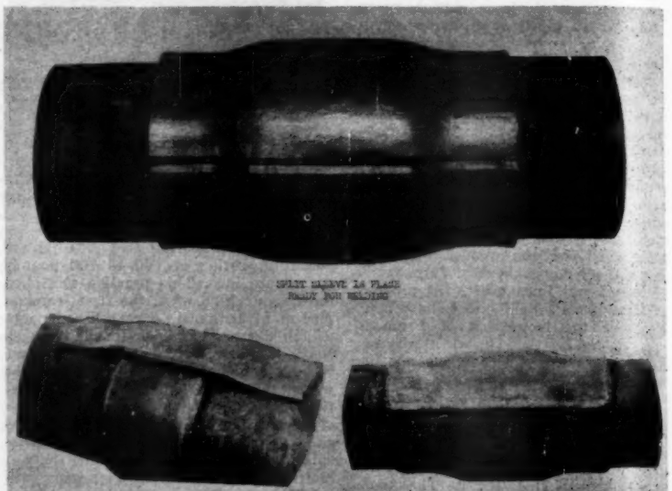


Fig. 5

The Use of Patches, "Slabs" and Half-Soles

14. One of the handicaps in maintaining pipe lines has always been that there has been no practical way of taking care of the oil drainage along the line, and it has always been a slow and inconvenient procedure to transfer the oil from one line to another parallel line. This problem will be discussed later under another heading, but it should be mentioned here that this handicap in pipe line maintenance, coupled with the necessity of keeping lines to capacity during the recent years, has been a material factor in bringing about the present practice of patching lines.

If a pit leak occurs, it is repaired in the manner described above, but an inspection of the whole surface of the joint of pipe will be made and if it is found that there are areas on the pipe which are deeply pitted, a patch sufficiently large to cover the area will be cut from a piece of pipe of the same diameter

The patch wil be pressed with hydraulic jacks so that the inside curvature will fit the outside curvature of the line to be repaired, the patch is tacked to the line and then electrically welded around all edges to the line. Some companies have put on as many as three or four patches on a single joint of pipe. The bottom of the pipe, where it rests firmly against the soil, holds the moisture and makes a good contact, is badly pitted sometimes while the upper half of the pipe is in good condition. Rather than replace the pipe, which would require a long shutdown to take care of the drainage, some companies have followed the practice of "half-soling" the joint. This procedure is similar to the use of the patch except in this case the patch becomes a half-sole, since it is cut almost large enough to cover the lower half of

Fig. 6

the pipe over the whole or part of the length of the pipe. The edges of the half-sole are electrically welded to the pipe in the same fashion as the patch. If the corrosion is limited to only the bottom of the pipe a "slab," which is similar to a half-sole except it does not cover as great an area of the pipe, is electrically welded to the pipe. The use of the patch, the slab and the half-sole are shown in Figure No. 3.

The Use of Casings

15. An inspection of the pipe in dry or shallow creeks, water courses and swamps often reveals that the pipe is in bad condition and should be replaced with good pipe. Operating conditions may not permit the necessary shutdown time to drain the line. In such cases many companies have resorted to the use of a large casing over the pipe. A straight casing can be used sometimes but very often in the case of creek crossings and water courses it is necessary to make use of a mitred casing such as shown in Figure No. 4 to fit over the sags. The casing of the line is done by splitting a larger piece of pipe into halves, swaging it down at the ends and fitting it over the smaller line. The length of the casing is electrically welded along the longitudinal seams and the girth joint is welded to the pipe. This procedure, except the casing is usually straight, is also used sometimes when old lines must be cased across newly constructed roads, especially if the oil drainage is large.

Spot Electric Welding

16. Soil corrosion results sometimes in only a few pits scattered over the surface of the pipe. If the pits are not too deep, spot welding has been used. This procedure involves the filling of the pits with a deposit of welding material through the use of the electric arc. Special care must be taken that these pits are not too deep on account of the burning through the wall of the pipe. In some cases, a small lug of steel is fitted into the pit and the metal is deposited with the electric arc to fill the corroded area. This work has been done with the line filled with oil and, in some cases, with the line in operation. It should be kept in mind that only the electric welding arc has been used in this work.

Repair of Leaking Couplings

17. This class of repair ranks second in the maintenance schedules of pipe lines. A thread and coupling joint in any system of piping is susceptible of developing leaks, and this is especially true of oil pipe lines, because rather large diameters are involved and the joints were made under the conditions of pipe line construction which were not favorable to the making of a tight and satisfactory joint. There may be more than a few causes contributing to the leaking of the joint; but cross threading, or the damaging of the thread when it was screwed into the coupling, has caused many of the leaks; out of roundness of the pipe or coupling is another factor. In the operation of the line, coupling leaks may occur after the operating pressure has been reduced, especially if the line has been strained by an excessive operating pressure. The contraction or expansion of the line during the temperature changes in the late fall and spring of the year effects a stress in the coupling which results in a leak that may be so small that the oil will not come to the surface of the ditch or sufficiently large to cause a pressure drop at the pumping station.

The customary practice of repairing leaky couplings has been, for years, the caulking of the coupling by the linewalker or repairman. This practice involves the peening of the metal of the coupling back against the threads by means of a caulking tool and hammer. If

Fig. 7

the leak could not be stopped by caulking, it was the usual practice to put on a collar leak clamp, which is a familiar piece of equipment in pipe line industry. It is not uncommon for couplings to spring leaks which cannot be repaired either by caulking or the collar leak clamp, and in such cases the regular stuffing box clamp was used.

These practices are still used in the pipe line industry, but to a lesser extent than before the use of electric welding. Under present practices, a leaking coupling may be caulked as in the past, but it is the usual practice of some companies to install a collar leak clamp as a temporary repair. If the leak is too bad to permit the use of a collar leak clamp, it is necessary to resort to the old practice of using a stuffing box. Before making a permanent repair on a leaking coupling, it has been the practice to caulk the coupling if the leak is not too bad, and electric weld both sides of it. If the coupling cannot be caulked entirely dry, or there is some weakness in the thread, general practice has been to electric weld a sleeve over the coupling. This sleeve, which is shown in Figure No. 5, consists of two halves of a piece of pipe of the right length forged to fit over the coupling. The longitudinal seams of the halves which are fitted over the coupling are welded, as well as the girth seams where the sleeve fits around the pipe. If there is any sign of the coupling leaking badly or being too weak to use the electric welding arc, it is necessary to cut out the coupling and replace it with a piece of pipe welded in the line. In general, the electric welded coupling without the sleeve has proved satisfactory, however, there have been quite a few sleeves which developed leaks later on as a result of pressure, and this type of repair is not entirely satisfactory. It should be pointed out again that the oxy-acetylene welding cannot be used for this class of service. However, the experience of the pipe line companies has been that the thread and coupling line involves continuous repairs. If one leaking coupling is repaired, it is just as likely that the strain will be taken up in the next joint, and a leak will develop in the next thread and coupling. There is no question that the thread and coupling line is obsolete, and is difficult to maintain. One of the most disconcerting features of the leaking coupling has been that very often the oil does not come to the surface of the ground and, as a result, the oil which leaked from the coupling lies in the ditch and in the soil adjacent to the pipe and results in a very serious corrosion of the pipe.

Resume of Patch Repairs

18. Except for the electric welding arc this patch work described above could not have been done, and it would have been necessary to drain the line, cut out the pipe and replace the old with new pipe, using a companion flange, or a right and left nipple, as in the earlier days—all of which was a slow, tedious and expensive job. The use of the companion flange or the right and left nipple was never desirable, especially the flange which in time developed leaks.

The use of the patch and gasket over pit leaks has served as not only a quick and inexpensive repair, but also a very satisfactory way. The electric welding of couplings has proved satisfactory; but the use of the large patches, half-soles, pipe casing, collar casings and spot welding has not been entirely reliable. Leaks have developed under the large patches, half-soles and in the casing, and the patches have not held against the pressure.

Fig. 9

There is an economic limitation to the use of half-soles, slabs, patches and casings, because it has been learned that in many of these cases a pipe replacement can be made at less expense and a most satisfactory job is obtained.

The use of the electric arc in making these types of repairs has become so promiscuous that there is a considerable element of danger involved. There will be a continued need of this type of repair, even though it is considered temporary in nature, and there will be an economical use for the electric welding of patches, couplings, and small pit patches. It is apparent that there will be certain risks involved, especially in welding couplings and every precaution should be observed to safeguard the lives of the welders and the workmen. It would be desirable to have a code of precautions to be observed in such work. The responsibility for carrying out this class of work rests rather heavily on the shoulders of operative men, who would prefer that an approved code be prepared for their guidance.

It is apparent that this class of work, which has been done instead of making replacements, has, in general, served only as an expediency during the last three or four years, while the industry has been formulating a more definite program for the maintenance of pipe lines. The welding of couplings and the use of small

Fig. 8

patches will be warranted, but the practice of making such extensive use of patches, slabs and half-soles cannot continue long without these lines becoming badly patched, and that is not a good maintenance program. Eventually, replacements will have to be made and the continued practice of patching only adds to the burden of the maintenance of these lines in future years.

The Depth Gauge

19. In coping with the corrosion problem of underground lines it is important that the men who are engaged in the maintenance of lines have a simple means of measuring corrosion pits, because it is necessary to have a common language not only for reconditioning lines, but also for the classification and salvaging of second-hand pipe. A simple depth gauge was not on the market, but C. M. Scott, chief engineer, and J. C. Stirling, corrosion engineer of the Stanolind Pipe Line Co., developed such a gauge which has been put in the hands of the superintendents, district foremen, connection foremen, and welders for their use in repairing and reconditioning lines, also for salvaging pipe. This simple device has standardized the judgment of the operating forces in this matter and has facilitated the making of decisions in cutting out pipe, repairing lines, and salvaging pipe. Reference will be made to the use of the gauge from time to time in the remaining discussions. The gauge is being manufactured by the Mooriane Co., Tulsa. It is made of a piece of polished

stainless steel about 2⅝ inches wide and 5¼ inches long, which is vest pocket size. The gauge is shown in Figure No. 6. The indicator arm "A," with a stylus to fit into the pits of the pipe, is pivoted to lower left-hand corner of the gauge. The guide "B" is a strip of metal soldered to the gauge to protect and guide the indicator arm. On either side of the guide, there are two scales; the scale on the right is shown as an arc and is expressed in sixteenths and thousandths part of an inch. The pit depth, which is multiplied about four times through the indicator arm is read directly on the scale in mils (thousandths of an inch) or in fractions. On the left side of the guide for the indicator arm there is a table showing the wall thickness of the various sizes of standard weight pipe. The thickness is shown in thousandths of an inch. This gauge has proved most valuable because it is so simple and at the same time sufficiently accurate for practical purposes. Such a gauge can be used and read by the average workman which is not true of the type of depth gauge which engineers use.

Practice of One Pipe Line Company With Respect to Patching

20. Although certain classes of this patch repairing is not satisfactory, it has been recognized by my company that, although it was desired to discontinue the use of large patches, casings and half-soles, it would be advantageous and economical to do a small amount of patch and spot welding and, consequently, the following instructions were proposed to guide the field men:

(A) The use of half-soles, large patches, slabs and casings will be discontinued in so far as possible. Their use will be permitted by consent from the general office.

(B) Surface conditions or tests may indicate a corrosive soil. In such a case the line will be uncovered and cleaned for a thorough inspection. One can determine quickly and decide by good judgment whether:

(a) The pipe is in good condition and requires no repair, or

(b) The pipe is so badly corroded and over such an area and length of line that the pipe must be replaced, or

(c) The pipe has corroded to some degree and the measurements of the pits will be necessary to decide on the class of repair to make.

(C) If the general condition of pipe is good, with the exception of a few isolated pits, the depth gauge will be used to measure the pits. The spot welding of pits will be permitted if there is between 100 and 130 mils of wall thickness left, and provided there are not over 20 pits per 20 feet. If there are more than 20 pits of this classification per joint, and the pitted section of the line exceeds 200 feet, the entire amount of pipe will be replaced. If the pits are spot welded all of the surface of the pipe will be cleaned thoroughly and given a double layer of the regular composite bonded coating of parolite and asbestos felt or concrete, depending on the cause of the corrosion or the nature of the soil.

(D) If the surface of the pipe is in fair condition but the pitted surface has 130 mils of wall thickness left, the pipe surface will be cleaned thoroughly. A double coating of asphalt and asbestos

Fig. 10

felt paper or a coating of concrete depending on the seriousness of the corrosion will be applied. Pressure tests up to 1,600 pounds on this class of pipe showed that this class of pipe could be left in the line. Tests indicate that the oil leak results from the pit "eating" almost through the wall of the pipe rather than the pressure blowing out the pits. This procedure is proving satisfactory and considerable expense has been eliminated in draining the line and replacing pipe; it is much more economical than patching for the line should also be coated even when patches are welded to the line. In the instructions "E," "F" and "G" which follow, it is to be understood that a protective coating, the character of which will depend on the severity of the corrosion, will be applied in addition to the repairs made by patching. Oil-soaked ground is always removed from the ditch and replaced with uncontaminated soil.

(E) Small patches will be welded over pits having less than 100 mils of wall thickness, provided the number of such patches does not exceed four per 20 feet, and that not more than 200 feet of pipe is corroded so as to require repairs or reconditioning, otherwise the pipe will be replaced.

(F) Patch welds will be made by the use of the electric arc welding, but not more than four small "pit" patches and one large patch (not to exceed 12 by 12 inches) will be permitted.

(G) In making repairs on lapweld pipe, the seam will be found first. Welding will not be permitted along the seam in the pipe for the heat may cause it to open and permit an escape of oil.

(H) The following tables, Nos. 1, 2 and 3, show respectively the depths of the pits for the different sizes of pipe. Table No. 1 shows the maximum depth of pits which will be permitted without spot welding or patching. Table No. 2 shows the range of the depth of pits for spot welding. Thus spot welding on 6-inch pipe, as shown in the first line of Table No. 2, will be permitted when the pit depth is more than 130 mils, but less than 180 mils. Table No. 3 shows the pit depths over which a patch must be used.

TABLE NO. 1—PIT DEPTHS PERMITTED WITHOUT PATCHING OR SPOT WELDING

Pipe sizes	Line pipe thickness (in mils)	Maximum pit depth (in mils) before welding is necessary
6-inch	280	150
8-inch	322	192
10-inch	365	235
12-inch	375	245

TABLE NO. 2—PIT DEPTHS BETWEEN WHICH SPOT WELDING WILL BE PERMITTED

Pipe sizes	Pit depths (in mils) From	To
6-inch	150	180
8-inch	192	222
10-inch	235	265
12-inch	245	275

TABLE NO. 3—PIT DEPTHS BEYOND WHICH A PATCH MUST BE USED

Pipe sizes	Pit depths (in mils) any depths over
6-inch	180
8-inch	222
10-inch	265
12-inch	275

(I) Repairs by welding will not be permitted until the pumping station has been shut down and the pumping pressure taken off the line.

(J) No repair work involving this class of welding can be done on the line until permission has been obtained from the general superintendent and the shut down order has been properly requested from the chief oil dispatcher, with a confirming message to the division superintendent and the chief station engineers of stations between which the repair work is being done.

(K) Telephonic communication will be established at the nearest point on the telephone line by means of a portable telephone set supplied each repair crew.

Fig. 11

Pulling of Couplings

21. One of the serious failures in pipe lines is the pulling of the thread out of the coupling. This usually occurs as a result of expansion and contraction of the line, when there is a sudden change of the temperature of the line during a cold rain and the wetting of the ground will permit the atmospheric temperature to be carried down to the line before the approach of winter, or during an exceptionally cold day in the winter and again when the thawing of the ground occurs in the spring. Usually a considerable amount of oil escapes from such a failure, but the loss of oil is either checked at the next station or the break will result in a drop of pressure at the pumping station, and repair crews are sent out to make repairs immediately. About the only type of repair that can be made on such a failure is the cutting out of the coupling and welding in a piece of pipe under present day methods. The customary practice in days gone by was to unscrew the coupling, cut the threads and set in a flange or right and left nipple. This was a very slow and tedious job because it was necessary to strip the ditch far enough back from the failure to permit the raising of the line to obtain the necessary slack to flange up. The usual practice now is to drain all the oil at a safe distance from the coupling which has failed, dig a bell-hole, strip enough of the line to set in a piece of pipe after the thread in the coupling has been cut off of the line. A considerable delay results in such a repair job on account of the oil drainage, which is necessary before a job of this kind can be done by welding.

Split Joints

22. Undoubtedly, an appreciable amount of pipe with defective lapwelds has gone into pipe lines in the past, and many of the failures in split joints have been on account of defective pipe when it was first installed; but, on the other hand, I have learned during the last few years that many of these joints have failed on account of an operating practice. After a line has been shut down and allowed to drain, a considerable amount of oil still remains in the line. Thus, if we consider a length of 40 miles, there may be 10 miles of oil which will drain from the line leaving perhaps 30 miles still standing idle in the line after the shut down. When a station resumes pumping it has been a customary practice of some companies to close the bypass within 30 minutes or an hour. No consideration was given to the fact that there was a good part of this line that had not yet been filled, and that there remained in the line a standing column of 30 miles of oil. The result is that when this 30 miles of standing oil is met by the 10 miles of oil moving at the rate of 2 to 3 feet per second, a collision occurs as a result of the attempt to start moving a column of oil 30 miles long at the same speed of 2 or 3 feet per second. The collision between the standing and the moving columns of oil may result in enough force to rupture the pipe, usually at or near the high point from which the drainage has occurred. The first occurrence of this kind may not result in a rupture of the line, but eventually the pipe is strained to the point where a failure will occur. About a year and a half ago our company prepared and sent a circular letter to all of the chief station engineers, superintendents and district foremen outlining in detail what

(Continued on Page 89)

Fig. 12

Cracking holds the key to crude production control, no matter who sets the allowables

What is the use of balancing crude production with "market demand" unless market demand means the smallest quantity of crude that can furnish the gasoline we need

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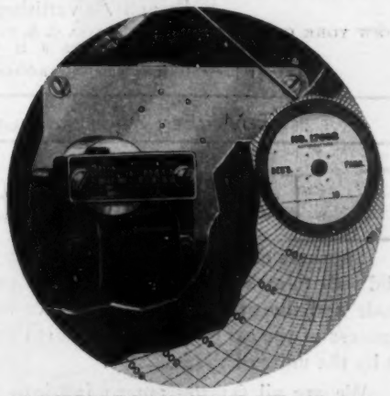

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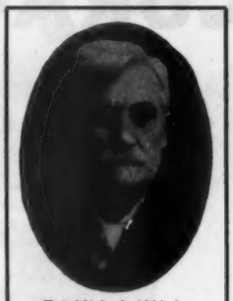

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Two Points at Chicago

Speakers at the American Petroleum Institute meeting in Chicago did well to stress one point—that the proclamation of the petroleum code and the official fixing of prices is only a beginning; that the success of the experiment depends entirely upon the support given to it by the units of the industry.

We are all far too apt to fall into the attitude of thinking the mere passing of a law or adoption of a resolution means an accomplished fact. Or to assume that because a committee or an enforcement agency has been appointed that everything is settled. Experience with the Eighteenth amendment ought to have taught us differently.

Laws depend far more upon habitual obedience, upon the active support of public opinion than upon occasional enforcement. First we have to rid ourselves of two ideas too generally heard. One is that it will be almost impossible to stamp out chiselers. The other is a "none of my business" tolerance of sharp dealers.

If the code is to get us out of the mess we have been in it must be everybody's business to stand up for it. There must be an end to easy going smiles at chiselers, however "smart". We must remember constantly that we and not merely our neighbors are the victims of cheating practices.

The twelve representatives of the industry on the Planning and Co-ordinating Committee and the thousand or more members of the regional and state committees named by that committee to supervise the working of the code throughout the country cannot do everything. Above all, they should not be stabbed in the back by snickering indifference. They should be made to feel that they have the active help of every honest man in the oil business.

If the Institute meeting carries home to each individual in the industry the necessity for sincere and serious support of the program it will have done a good and needed work.

The real job lies ahead. What we have got so far is merely the plans. We now have to work them out. We cannot even hold what we have unless we do. There can be no standing still, no "waiting to see."

All these complicated details of actual operation must be ironed out. All these difficulties and dodges must be taken care of. They can be, if the common good of the industry is put before selfishness, if men can be brought to see that their share in the permanent betterment of the industry means more to them than any immediate personal advantage.

Those who have no permanent interest in the oil business but who entered it merely in hope of quick profits regardless of the effect upon the business as a whole must be made to obey the rules for the general good under the code.

Specious pleas of devotion to the consumer should nowadays deceive no one. There is no virtue in mere cheapness. In the past four years we have run the gamut on cheapness to the lowest pitch and look where we landed!

We have learned, as a people, that selling to each other below cost means shut down industries, bankruptcies, and unemployment, and that the only way out is to restore a profit to industry and business.

Although the demand for gasoline has held up better than the demand for practically any other industrial product the price has fallen lower because of unfair competitive conditions.

The Department of Labor figures for August, the latest available, show that petroleum products stood at 40.9 per cent of their 1926 price, while agricultural products were 57.6 per cent and all commodities 69.5 per cent of what they were in the government's normal year.

Despite these facts gasoline consumers are being told by interested parties that any increase in price is profiteering. Chairman Wirt Franklin of the Planning and Co-ordinating Committee did well to deal with this in his address at Chicago.

Next to vigorous co-operation behind the code the industry most needs to inform the public on this question of gasoline prices.

Mr. Franklin fittingly spoke of the levy on gasoline, which at times has been over 200 per cent of the wholesale price, as "concealed taxation". The consumer did not feel it when gasoline was selling at distress prices and the legislators were piling on the tax, but now he is told the oil industry, alone of all industries, must not return to living prices.

In the past ten years, as President A. J. Byles pointed out, the tax collector has taken a billion dollars more out of the oil business than the industry itself.

Every day is tax day for the gasoline consumer. He may think he is paying for gasoline, but thirty cents out of every dollar goes to the tax collector.

Yet, even with that, gasoline prices today, on an average, are less than they were in 1926, the year which the government has chosen as the model for national recovery prices, and less than the average for the past 20 years.

With a case as good as that the oil industry should take it at once to the people and silence once for all this propaganda of the price cutter and the politician.

The American people are intelligent and fair. They have accepted price increases in everything else as a necessary part of the national recovery movement. They have been tolerant and patient even where prices have gone beyond reason.

They have no cause for complaint against the oil industry on gasoline prices as they can see by comparison with either 1926 or the average for 20 years. In fact the industry is getting less, while taxes are more, and yet the price is below normal.

Instead of profiteering, the oil industry has had its price so low that taxes have been more than doubled without the public feeling it. Now that it asks only a living return fairness should grant it without complaint.

Agitation among consumers should be directed against the real burden—the increase of taxes, a large portion of which is not being used for the only special purpose motor owners should ever be asked to pay—for the improvement of the public highways, but is being spent for general purposes and is being paid by the car owner as an additional tax above the taxes he pays as an ordinary taxpayer.

These are facts the public should understand and the oil industry should see that they are made plain.

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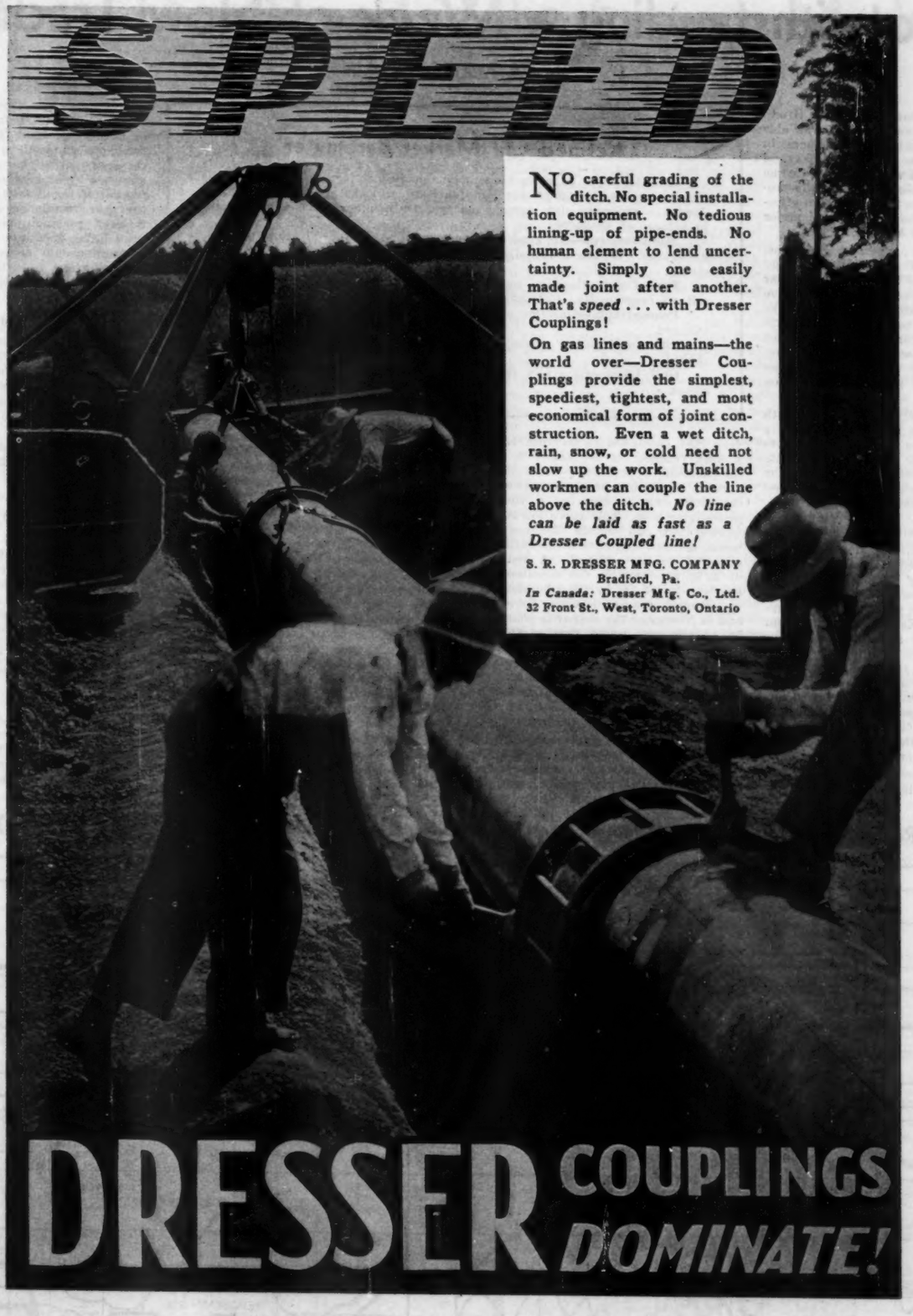
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Gains Shown in Mid-Continent Refinery Market Notwithstanding a Week of Slow Trading

By W. T. ZIEGENHAIN

Despite rather slow trading, the Group 3 (Oklahoma) refinery market was able to record fractional price advances in gasoline, distillates, cylinder stocks and wax during the last week. The turn came early in the week, following the announcement of Secretary Ickes that effective December 1 the prices on all major oil products would be fixed.

The fixed prices on gasoline, kerosene, distillates and fuel oils are higher than the present level so that within the next 32 days of trading adjustments will have to be made. Realizing this must take place, buyers are seeking bids for supplies over November at today's market level, but almost without exception refiners are turning down such business in favor of trade paper quotations on date of shipment.

Jobbers are pretty well stocked with kerosene, distillates and fuel oils and in general they see no need to rush orders through. Until the winter season eats into consumer supplies more deeply the buyers of these products appear to choose a program of watchful waiting.

Need to Curb Refinery Runs

Mid-Continent refinery crude runs continue high compared to those of a year ago. Approximately 100,000 more barrels of oil is being processed daily than at the same period last year. Gasoline stocks in Oklahoma and Kansas are 18 per cent higher than a year ago and the gasoline stocks of the entire country are in excess of those of a year ago. During the first seven months of 1933 refiners were able to hold stocks considerably below those of a year ago and the reason for not being able to continue this showing may be found in the review of refinery crude runs for the two periods.

Last year refiners started curtailing operations in the middle of June. This year they continued to increase runs to a peak reached on September 1. Thus the immediate problem is equitably to allocate crude runs at a reduced total as the first step in assuring a workable price-fixing plan. This allocation is being worked out and within the next few weeks definite schedules of operation are expected to be assigned. A reduction of 12½ per cent in the gasoline yield has been hoped for by the administration in October compared with September, and in November the output is planned to be 15 per cent under that of October. Subsequent gasoline production probably will be curtailed to allow for overages creeping into the plan during October and November, while the organization of supervisory committees under the Government's plan is being perfected.

Unless the program of price-fixing is to go completely "hay-wire" it should be obvious to jobbers and consumers that they are going to pay more for refinery products over the next three months than at present. Also it looks now as though the price-fixing machinery is being built strong enough to take some hard bumps without being shaken to pieces.

Refined Oil Market Barometer

Announcement of price fixing plan enabled refiners to advance gasoline quotations throughout the Mid-Continent, Chicago and California areas despite a generally slow moving market. Only minor changes were made in balance of products.

Mid-Continent—All grades refinery gasoline advance. Natural gasoline unchanged. Kerosene and distillates firm. Wax advanced and unusually strong.

East Coast—Gasoline unchanged. Cylinder stocks and bright stocks sell off fractionally. Pale neutrals strong, red neutrals weak.

Pennsylvania—Gasoline slightly weaker. Wax advanced. Balance unchanged.

Chicago—Gasoline advanced. Low gravity fuel more plentiful and price shaded.

Gulf Coast—Generally firm market. Low gravity fuel and kerosene strong.

Gasoline

The principal source of cheap Mid-Continent low octane gasoline has been East Texas and the low prices there have been damaging to the rest of the gasoline price structure. In the last week, however, prices in East Texas have been advanced to a low of 3⅞ cents and the bulk of the material is moving at 4 to 4⅛ cents. This has permitted Oklahoma refiners to take a different attitude in regard to their low octane material and trading was carried on at 4¼ to 4½ cents. This represents an advance of one-quarter cent over a week ago and a similar increase is shown in the regular and premium grades of U. S. Motor gasoline.

Manufacturers were able to maintain a 5¼-cent market for the 26-70 grade of natural gasoline. There is a tendency for more material to find its way into the spot market, but so far it is readily absorbed by brokers and refiners who are committed for abnormally large purchases over the remainder of October. As the refinery gasoline price strengthens and price fixing goes into effect on December 1, there should be no serious break in natural prices even though a temporary oversupply should appear in the market in November.

Kerosene and Distillates

Kerosene was stronger at 3½ cents. Early in the week some material under standard quality changed hands at prices under that figure but by Tuesday the market was firmly established at this minimum and the better grade was bringing 3¾ cents.

Distillates were also strong at last week's price level. The 38-40 straw low-flash furnace oil was actively traded at 2⅞ to 3¼ cents.

Gas Oil and Fuel Oils

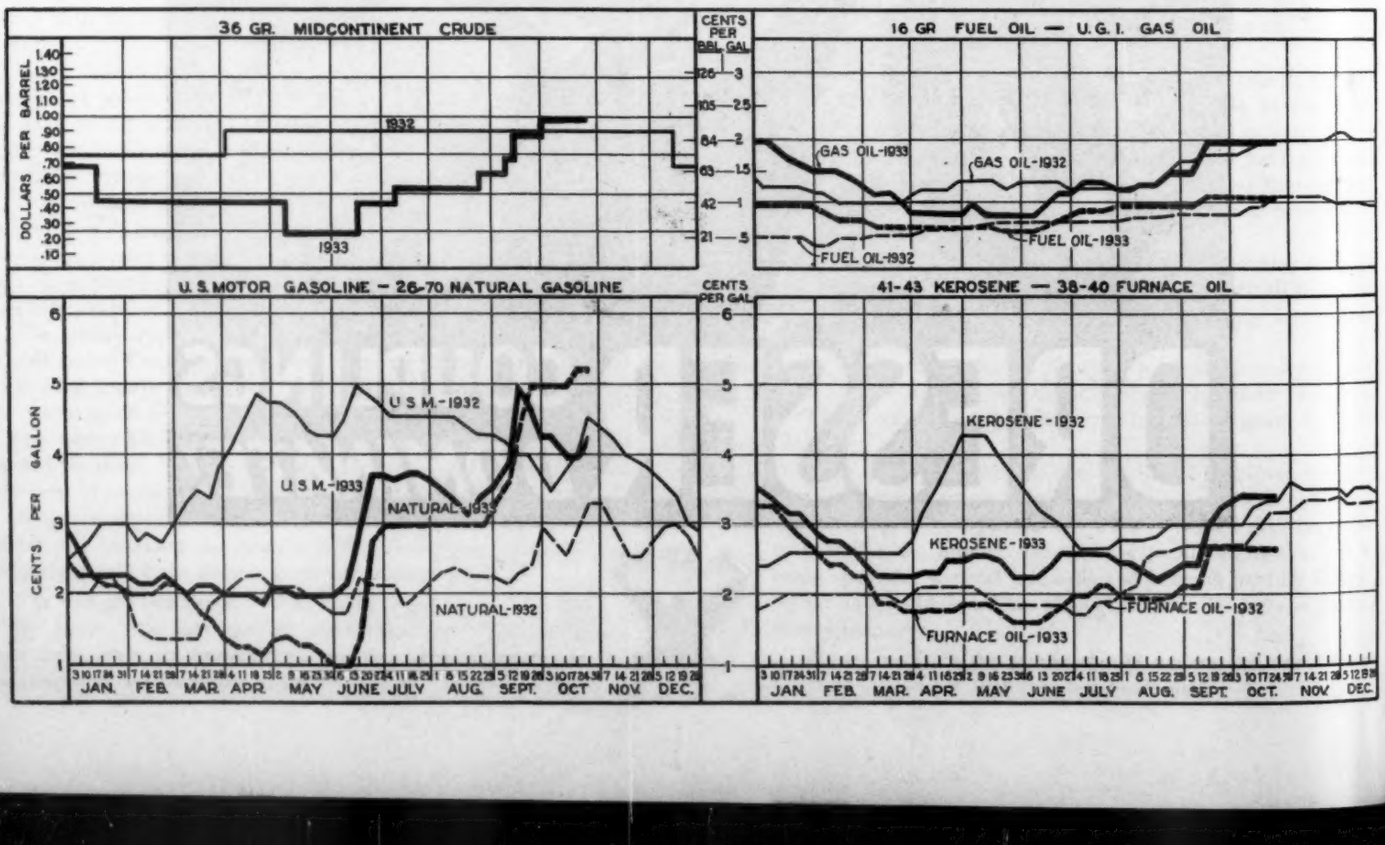
There was no price change throughout the list of gas oils, but buyers stressed their demands for low cold test material. The light fuel oils, particularly the 28-30 zero to 10 cold test grade was actively sought. The more exacting specifications demanded caused refiners to ask up to $1.05 for the rerun material having a viscosity under 75. The blended grade under 100 viscosity brought a minimum of 85 cents.

Lubricants and Wax

Cylinder stocks were the only class of lubricants to register an advance in price for the week, but neutral and bright

(Continued on Page 48)

Representative Mid-Continent Quotations on Crude Oil and Refined Products Basis Oklahoma (Group 3)



Many Retail Problems Arising Under the Code Being Developed in the Eastern Market

By C. O WILLSON
New York Bureau, The Oil and Gas Journal

NEW YORK, Oct. 23.—The announcement last week that the Government would approve a price fixing plan for the oil industry effective December 1 came as a surprise to the majority of the marketing trade in this territory and the first of this week it was not apparent what immediate effect if any the change in the Government's attitude would have on prices for refinery products. The announcement which came after a majority of the trade had ceased to expect it did serve to bring a firmer market tone to practically all products but no important advantages in quotations have materialized. Buying was not stimulated to any considerable degree although many in the trade are predicting that the certainty of higher prices for some of the products under the plan to be made effective not later than December 1, will soon result in a more active domestic market.

A careful check of prices the first of the week failed to reveal any important changes in quotations either up or down the sellers being content to continue the quotations which in most cases have been in effect since the first of the month. In the case of gasoline the Government's shift to a supporting position for regulation of minimum prices may have averted a general decline in tank car and service station quotations. The gasoline retail market situation has become worse instead of better in the matter of price reductions and it is no secret that some of the major distributors previous to the government announcement were preparing to meet these lower prices of independent operators wherever they developed and it appeared that a reduction of 1 cent or more per gallon would spread to all the Atlantic Seaboard states.

Concern regarding this situation has not ceased but the attitude now is to wait and see what effect the position of the Government in regard to price control will have in remedying this situation. Postponement of the effective date until December 1 is not received with favor by some who have immediate retail problems to solve. As explained in these market columns previously distributors who are accustomed to undersell the major companies selling branded products are refusing to abide by the provisions of the oil industry's NRA code and in the consumers' markets have reduced their prices from 1 to 4 cents per gallon at many points. As usual under such conditions these cut-rate operators have increased their gallonage, taking business away from those companies who are maintaining prices in line with the recent increased cost of manufacture.

Cost of Production

In the present situation a condition has brought a problem which no doubt the representatives of the Government and the industry at Washington will be asked to solve. The oil industry's code, aside from the price fixing feature announced last week, provides that refinery products cannot be sold below the cost of the production. As interpreted by the Government the cost of production must be considered in divisions, i.e., crude oil production, refining and the various steps of marketing.

This ruling has deterred some of the major distributors in meeting low prices established by independent jobbers and distributors. In a strict interpretation of the ruling presumably no company could reduce its retail and tank wagon prices unless it could show that the reduction was not below its cost of marketing. At the same time the independent operator making the low price may be able to show the Government that due to large volume and low overhead he can make a profit at the low prices and for that reason is not violating the code's provisions. In brief this brings to the front the well-known fact that in petroleum merchandizing retail costs are largely dependent upon volume of business per unit of distribution. A station selling 125 gallons of gasoline per day can materially change its cost position if it is allowed to reduce price and take business away from its competitors and increase its gallonage to 500 or more per day. The price fixing plan approved by the Government presumably takes care of this situation by establishing a fixed margin of 6½ cents per gallon between the delivered gasoline tank car and service station prices.

The foregoing is only one of the hundred and one questions or problems that have come to the mind of managers of tank car, tank wagon and service station sales with the announcement that price fixing for the first time in the history of a major industry, was to be tried out in the oil business starting in six weeks. As is generally known there are large and small companies on both sides of the fence in regard to the desirability of price control governing the production of crude oil and the manufacture and distribution of petroleum products. There is nothing to indicate yet that those who oppose price fixing will not go along with the program at the time it becomes effective. However, it is already apparent that certain companies and associations will appear at the hearings to be held next month in Washington and endeavor to obtain changes in the plan to which they believe they are entitled due to some peculiar operating condition.

Refinery Control

Regarding price control and the entire NRA program for the oil industry the statement of one sales executive is representative. "If they curtail crude oil production and crude runs to stills in line with consumer requirements the minimum prices established by the Government can no doubt be maintained," said this executive, "but if they do not the entire plan is certain to collapse. Neither the Government nor the industry can possibly police the sale of petroleum products and maintain prices in the face of a weak market brought by continued overproduction."

In this connection the latest announced plan to place refinery operations directly under the control of the Government and thus restrict operations to demand and prevent excessive runs based on speculative requirements, is viewed favorably here. It is thought that it is second only to the curtailment of crude oil production as a background for stabilization of the industry's markets.

The price fixing program (see complete report in the October 19 issue of The Oil and Gas Journal) for the Eastern Seaboard provides a minimum price of 7¼ cents at terminals for the 60-64.9 octane grade and a 7½-cent tank car price. The above 65 octane grade will be one-half cent higher. Kerosene will be 6 to 6¼ cents. These prices which do not become compulsory under the government plan before December 1, as minimum prices, are approximately 1 cent more than the prices prevailing for gasoline at East Coast points at this time and one-half to three-quarters cent more than the kerosene price. The price of 4½ to 4¾ cents for gas oil of 30 gravity and above is in line with the present market and the proposed minimum price of $1.05 for bunker "C" fuel oil is 5 cents per barrel less than the present market of $1.10.

There are predictions that these minimum prices for gasoline and kerosene will be established as the going market in this territory long before December 1 while others believe that sellers will do well to maintain present quotations. Much will depend on the success of the Government's committee at Washington in keeping crude oil production and refinery operations in line with demand. It is contended here that several weeks of restricted operations will be neces-

(Continued on Page 99)

American Petroleum Institute Weekly Refinery Statistics

Figures below reported for week by American Petroleum Institute. (1) Per cent refinery capacity represented. (2) Daily average crude runs to stills. (3) Total motor fuel stocks. (4) Gas oil and fuel oil stocks. All figures in 42-gallon barrels.

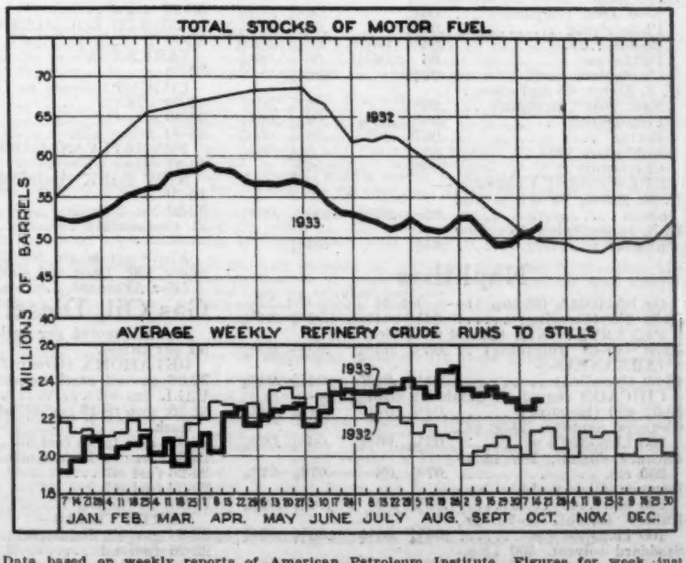
Week Ending October 21, 1933, Compared to Week Ago

	Week Ending Oct. 21, 1933				Week Ending Oct. 14, 1933			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	100.0	482,000	14,019,000	9,221,000	100.0	466,000	13,945,000	9,336,000
Appalachian	92.6	101,000	1,957,000	872,000	92.6	104,000	1,928,000	894,000
Ind., Ill., Ky.	97.3	330,000	7,546,000	6,066,900	97.3	338,000	7,364,000	6,069,000
Okla., Kans., Mo.	82 1	237,000	5,656,000	4,271,000	82.1	242,000	5,382,000	4,302,000
Inland Texas	60.2	81,000	1,310,000	1,818,000	60 2	90,000	1,335,000	1,832,000
Texas Gulf	98.0	466,000	5,502,000	6,842,000	98.0	444,000	5,548,000	6,869,000
Louisiana Gulf	100.0	130,000	1,347,000	1,914,000	100 0	97,000	1,264,000	1,996,000
N. La. and Ark.	92.6	53,000	250,000	634,000	92.6	48,000	252,000	630,000
Rocky Mnt.	78.8	37,000	834,000	719,000	78 8	37,000	852,000	710,000
California	96 9	431,000	14,331,000	97,541,000	96.9	437,000	14,129,000	98,334,000
Total U. S.	92.4	2,348,000	52,752,000	129,898,000	92 4	2,303,000	51,999,000	130,912,000

Totor motor fuel stocks, Bureau of Mines basis, 54,550,000 bbls.

Week Ending October 21, 1933, Compared to Year Ago

	Week Ending Oct. 21, 1933				Week Ending Oct. 22, 1932			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	100.0	482,000	14,019,000	9,221,000	99 1	423,000	13,307,000	9,146,000
Appalachian	92.6	101,000	1,957,000	872,000	95.0	100,000	1,577,000	769,000
Ind., Ill., Ky.	97.3	330,000	7,546,000	6,066,000	97.5	303,000	6,078,000	4,116,000
Okla., Kans., Mo.	82 1	237,000	5,656,000	4,271,000	88.4	226,000	4,516,000	3,000,000
Inland Texas	60.2	81,000	1,310,000	1,818,000	72.1	99,000	1,372,000	2,081,000
Texas Gulf	98.0	466,000	5,502,000	6,842,000	98 2	389,000	5,293,000	9,760,000
Louisiana Gulf	100.0	130,000	1,347,000	1,914,000	97 3	75,000	1,470,000	3,931,000
N. La. and Ark.	92.6	53,000	250,000	634,000	94 6	45,000	188,000	526,000
Rocky Mtn.	78.8	37,000	834,000	719,000	91 4	33,000	1,185,000	459,000
California	96 9	431,000	14,331,000	97,541,000	94.6	452,000	14,779,000	100,967,000
Total U. S.	92.4	2,348,000	52,752,000	129,898,000	93 6	2,145,000	49,765,000	134,755,000



Data based on weekly reports of American Petroleum Institute. Figures for week just ended not shown in graph but are included in accompanying table.

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement except as otherwise noted

EXCLUSIVE OF TAXES

The following quotations are exclusive of the Federal excise taxes of 1½ cents a gallon on gasoline and 4 cents on lubricating oils, which became effective June 17, 1933.

Refinery Gasolines

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
*U. S. Motor grades:				
Third grade	.04¼	.04½	.04	.04¼
Regular	.05	.05½	.04¾	.05
Premium	.05½	.05¾	.05½	.05½
60-62 400 grades:				
Third grade	.04⅜	.04¾	.04⅛	.04⅜
Regular	.05⅛	.05⅝	.05	.05¼
Premium	.05⅝	.05¾	.05⅜	.05⅝
64-66 390	.04¾	.05⅛	.04⅝	.05
64-66 375	.05	.05¼	.04¾	.05¼
68-70 350	.05¼		.05	.05¼
NORTH TEXAS—				
U. S. Motor grades:				
Third grade	.04	.04¼	.03⅞	.04⅛
Regular	.04⅝	.05	.04¼	.04¾
Premium	.05¼	.05½	.05	
60-62 400	.04½		.04¼	.04½
64-66 390	.04⅞	.05¼	.04⅝	.04⅝
64-66 375	.05		.04¾	.05
64-66 360	.05⅛	.05¼	.05	.05⅛
†NORTH LOUISIANA—				
U. S. Motor grades:				
Third grade	.04¾		.04¼	
Regular	.05½		.05¼	
Premium	.06		.05¾	
60-62 400	.04½		.04½	
†ARKANSAS—				
U. S. Motor grades:				
Third grade	.04¾		.04¼	.04½
Regular	.05⅝	.05½	.05¼	.05⅝
Premium	.06		.05¾	
CHICAGO (based on Oklahoma Group 3)—				
U. S. Motor grades:				
Third grade	.04¼	.04½	.04⅛	.04¼
Regular	.05	.05¼	.04⅞	.05
Premium	.05½	.05⅝	.05¼	.05½
60-62 400	.04⅝	.04½	.04¼	.04⅝
64-63 375	.05	.05¼	.04⅞	.05
68-70 360	.05¼	.05½	.05½	
Aviation fighting grade	.05⅝	.05⅞	.05½	.05¾

***Octane Ratings—The following octane ratings apply to the three grades of U. S. Motor gasoline: Regular 60-64 octane number, premium 65 and above octane number; third grade, 59 and below octane number. Octane ratings determined by C.F.R. Motor Method.**

PENNSYLVANIA (inland refineries)—				
U. S. Motor	.05⅝	.05⅝	.05½	.05¾
60-62 400	.05½	.05⅝	.05⅝	.05⅞
64-66 375	.05⅞	.06⅛	.06	.06¼
68-70 350	.06½	.06¾	.06½	.06¾
CALIFORNIA (domestic movement)—				
54-58 U. S. Motor	.07½	.08½	.07	.08½
58-60 400	.08¼	.09	.08	.09
EAST COAST—				
U. S. Motor, below 65 octane:				
New York (Bayonne)	.06¼		.06¼	.06½
Philadelphia	.06¼		.06¼	.06½
Boston	.06½	.0670	.06½	.0670
Baltimore	.06	.06¼	.06	.06¼
Charleston, S. C.	.06¼		.06¼	
U. S. Motor, 65 and above:				
New York (Bayonne)	.06½		.06½	.06¾
Philadelphia	.06½	.06¾	.06½	.06¾
Boston	.0670	.0695	.06¾	.0695
Baltimore, Md.	.03½		.06¼	.06½
Charleston, S. C.	.06½		.06½	
GULF COAST (domestic)—				
U. S. Motor, 65 octane and above	.06	.06¼	.06	.06¼
U. S. Motor, below 65 octane number	.05¾		.05¾	

Naphthas

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
50-52 450 (blending)	.04¼	.04½	.04¼	.04½
PENNSYLVANIA (inland refineries)—				
50-54 430-45[illegible] (blending)	.05⅝	.05⅞	.05½	.05¾
†ARKANSAS—				
48-50 (blending)	.04½	.04¾	.04½	.04¾
CHICAGO (based on Oklahoma Group 3)—				
50-52 450 (blending)	.04¼	.04½	.04¼	.04½
Cleaners' naphtha, 56-58 gr., 200 i.b.p.-320 e.p.	.06½	.06¾	.06½	.06¾
Lacquer diluent, 180 i.b.p.-250 e.p.	.07¾	.08	.07¾	.07⅞
Lacquer diluent, 140 i.b.p.-200 e.p.	.08¾	.00	.08¾	.08⅞
Rubber solvent, 68-70 gr., 100 i.b.p.-300 e.p.	.06¼	.06½	.06¼	.06⅝
Stoddard solvent, 300 i.b.p.-410 e.p., over 83° flash	.06⅛	.06¼	.06¼	.06¼
Petroleum thinner, 290-300 i.b.p., 415 e.p., over 83° flash	.05¾		.05¾	
V.M.&P. naphtha, 56-58 gr., 190-200 i.b.p.-330 e.p.	.06		.06	
Petroleum spirits	.05¼	.05⅝	.05¼	.05¾

Natural Gasolines

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
Grade 18-55	.06	.06¼	.06⅜	
Grade 26-70	.05¼		.05¼	
Grade 30-70	.04⅞		.04⅞	
Low vapor pressure grades:				
15 lb. v.p. (max.)	.06¼	.06½	.06⅜	.06½
11 lb. v.p. (max.)	.06½		.06½	
NORTH TEXAS—				
Grade 18-55	.05⅞	.06	.06¼	
Grade 26-70	.05⅛		.05⅛	
Grade 30-70	.04⅞	.04¾	.04⅝	
Low vapor pressure grades:				
15 lb. v.p. (max.)	.06½	.06¼	.06¼	
11 lb. v.p. (max.)	.06⅜	.06½	.06¼	.06⅜
NORTH LOUISIANA—				
Grade 26-70	.05½		.05½	
CALIFORNIA—				
75-85 375	.06	.07	.05¾	.06¾

Kerosenes

(All kerosenes water white)

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
41-43	.03½		.03½	
42-44	.03⅝	.03¾	.03⅝	.03⅞
NORTH TEXAS—				
40-41	.03¼		.03⅛	.03¼
41-43	.03¼	.03⅜	.03¼	
†NORTH LOUISIANA—				
41-43	.03¾	.04	.03¾	
42-44	.04		.04	
†ARKANSAS—				
41-43	.03¾		.03⅞	
PENNSYLVANIA (inland refineries)—				
45	.04¾	.05	.04¾	.05
46	.05	.05⅜	.04⅞	.05⅛
47	.05¼	.05½	.05⅛	.05⅜
CHICAGO (based on Oklahoma Group 3)—				
41-43	.03⅜	.03½	.03⅜	.03½
42-44	.03½	.03⅝	.03⅜	.03⅝
*CALIFORNIA—				
38-40 high burning test	.04¼	.04¾	.04¼	.04¾
NEW YORK (Bayonne, N. J.)—				
41-43	.05½		.05½	
GULF COAST (domestic)—				
41-43 water white	.04½	.04¾	.04½	.04¾

***For Pacific Coast consumption.**
†For Arkansas, Louisiana and Mississippi delivery.

Furnace Oils and Tractor Fuels

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
32-36 straw	.02⅞	.03	.02⅞	.03⅛
36-38 straw	.02⅞		.02⅞	
38-40 straw	.02⅞	.03¼	.02⅞	.03¼
39-41 prime	.03		.03	
NORTH TEXAS—				
38-40 straw	.02⅝	.02¾	.02⅝	.02¾
†NORTH LOUISIANA—				
38-40	.03		.03	
†ARKANSAS—				
32-36	.03		.03	
CHICAGO (based on Oklahoma Group 3)—				
32-36 straw	.02⅝	.03	.02⅞	.03
38-40 straw	.02⅞	.03	.02⅞	.03
38-40 prime white	.03	.03¼	.03	.03⅛
PENNSYLVANIA (inland refineries)—				
40-41 prime white	.04	.04⅛	.04	.04⅛
NEW YORK (Bayonne, N. J.)—				
36-40	.05½		.05½	
32-36 No. 2 grade	.04½		.04½	
21 (industrial)	.04		.04	

Above prices are for distillate oils of zero cold test under 190° flash and good odor.
†For Arkansas, Louisiana and Mississippi delivery.

Gas Oil, Diesel Oil and Fuel Oil

Gas oil quoted per gallon basis; Diesel oil and fuel oil per barrel.

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
32-36 gas oil cracking stock	.01⅞	.02⅛	.01⅞	.02⅛
U.G.I. gas oil	.02		.02	
32-36, zero to 15 gas oil, high flash	.02¼	.02⅜	.02¼	.02⅜
28-3[illegible], zero to 10 fuel oil	.85	1.05	.85	.92½
26-30, zero to 10 fuel oil	.82½	.95	.82½	.90
24-26 fuel oil	.62½	.65	.62½	.65
20-22 fuel oil	.55	.60	.55	.60
Below 16 fuel oil	.50	.55	.50	.55
NORTH TEXAS—				
32-36 gas oil, industrial	.02		.02	
22-26 fuel oil	.57½	.62½	.57½	.62½
Below 20 fuel oil	.47½	.50	.47½	.50
†NORTH LOUISIANA—				
32-36 gas oil, zero	.03		.03	
14-16 fuel oil	.55	.60	.50	.60
†ARKANSAS—				
30-32 gas oil, zero	.02¾	.03	.02¾	.03
14-16 fuel oil	.50	.55	.50	.55
CHICAGO (based on Oklahoma Group 3)—				
32-36 gas oil, industrial	.01⅞	.02	.01¾	.02
28-30 (zero) fuel oil	.85	.95	.85	.92½
26-28 (zero) fuel oil	.75	.77½	.75	.77½
22-26 (zero) fuel oil	.65	.67½	.65	.67½
18-22 (zero) fuel oil	.57½	.62½	.57½	.60
Below 18 fuel oil	.42½	.45	.42½	.47½

Note: Fuel oils of more than 40 cold test generally 5 to 15 cents per barrel less in all areas than shown in above tables.
†For Arkansas, Louisiana and Mississippi delivery.

PENNSYLVANIA (inland refineries)—				
36-40	.03⅞	.04	.03⅞	.04
CALIFORNIA—				
30-34 gas oil per bbl.	.90	1.05	.90	1.05
27 plus Diesel	.90	1.00	.90	1.00
15-19 bunker (at tidewater)	.55	.65	.55	.65
15-19 (cargo lots)	.50	.60	.50	.60
15-19 (tank cars)	.45	.65	.45	.65
GULF COAST—				
28-30 gas oil	.03½		.03½	
28-30 Diesel	1.80		1.80	
Bunker C (bulk cargoes)	.92½	.95	.92½	.95
Bunker C (bunkers)	.95		.95	
NEW YORK (Bayonne, N. J.)—				
28 plus. gas oil	.04½		.04½	
28-30 Diesel (lighterage 6½ cents per bbl.)	1.95		1.95	
28-30 Diesel (tank cars)	.04½		.04½	
*Bunker C (to ocean-going ships in N. Y. harbor)	1.10		1.10	

***Lighterage charge 5 cents additional.**

Petroleum Coke*

Prices per ton f.o.b. refineries in Chicago area.

	Oct. 24	Oct. 17
Pile run (screenings)	4.50	5.25
Direct from still	5.50	6.25
Lump and egg	7.50 7.75	7.00

***Refineries will absorb freight to 80 cents a ton.**

Neutral Oils

(Viscosity at 100° F. and color)

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
Zero to 10 Cold Test:				
150-3	.07¼	.07½	.07¼	.07½
180-3	.08½	.08¾	.08½	.08¾
180-4	.08¼	.08½	.08¼	.08½
200-3	.09	.09¼	.09	.09¼
200-4	.08¾	.09	.08¾	.09
240-3	.11	.11¼	.11	.11¼
240-4	.10¾	.11	.10¾	.11
28[illegible]-3	.12	.12¼	.12	.12¼
280-4	.11½	.11¾	.11½	.11¾
300-3½	.12¾	.13	.12¾	.13
350-3½	.13¾	.14	.13¾	.14
400-4	.14¾	.15	.14¾	.15
500-4½	.15¾	.16	.15¾	.16
100-2 paraffin oil	.05¼	.05½	.05¼	.05½
15-30 Cold Test:				
200-3	.08¼	.08½	.08¼	.08½
200-4	.08	.08¼	.08	.08¼
240-3	.10¾	.10½	.10¼	.10½
240-4	.10	.10¼	.10	.10¼
280-3	.11¼	.11½	.11¼	.11½
280-4	.11	.11¼	.11	.11¼
PENNSYLVANIA—				
150 vis., No. 3, 400-405:				
Zero pour test	.17	.17½	.17	.17½
10 pour test	.16½	.16¾	.16½	.16¾
15 pour test	.15	.15¼	.15	.15¼
25 pour test	.14¼	.14½	.14¼	.14½
180 vis., No. 3, 25 pour test	.16¾	.17	.16¾	.17
200 vis., No. 3:				
Zero pour test	.21½	.21¾	.21½	.21¾
10 pour test	.20½	.20¾	.2[illegible]½	.20¾
15 pour test	.19½	.19¾	.19½	.19¾
25 pour test	.19¼	.19½	.19¼	.19½
GULF COAST—				
Pale Oils:				
200-3	.06½		.06½	
300-3	.07	.07½	.07	.07½
500-3½	.07¾	.08¼	.07¾	.08¼
750-3½	.08½	.09	.08½	.09
1,200-3½	.09⅛	.09½	.09⅛	.09½
2,000-4	.10	.10½	.10	.10½
Red Oils:				
200-5-6	.05½		.05½	
300-5-6	.06	.06½	.06	.06½
500-5-6	.06¾	.07¼	.06¾	.07¼
750	.07½	.08	.07½	.08
1,200-5-6	.08¼	.08¾	.08¼	.08¾
2,000-6 plus	.09½	.09¾	.09½	.09¾

CALIFORNIA—				
Pale Oils:				
100-2½-3	.09	.09½	.09	.09½
200-2½-3	.09½	.10	.09½	.10
300-3-3½	.10½	.11	.10½	.11
350-3-4	.11	.11½	.11	.11½
400-3-4	.11¼	.11¾	.11¼	.11¾
450-3-4	.11¾	.12	.11¾	.12
500-3-4	.12	.12½	.12	.12½
600-3-4	.12	.13		
Red Oils:				
200-4-5	.09½	.10	.09½	.10
300-5-6	.10½	.11	.10½	.11
350-5-6	.11	.11½	.11	.11½
400-5-6	.11½	.11¾	.11½	.11¾
450-5-6	.11¾	.12	.11¾	.12
500-5-6	.12	.12¼	.12	.12¼
600-5-6½	.12¼	.12½	.12¼	.12½
700-6½ plus	.12½	.12¾	.12½	.12¾
750-6½ plus	.12¾	.13	.12¾	.13
900-6½ plus	.13	.14	.13	.14

Bright and Steam Refined Stocks

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
630 light green	.09	.12	.06¾	.07¾
600 light green S.R.	.07	.09	.06¼	.07¼
600 dark green S.R.	.05	.07	.04¾	.05¾
Bright Stocks:				
190-200 D	.24	.25	.24	.25
150-160 D, 0-10	.22¼	.22½	.22¼	.22½
150-160 D, 10-25	.21¾		.21¾	
150-160 D, 25-40	.21¼		.21¼	
150-160 E	.20½		.20½	
PENNSYLVANIA—				
600 S.R.	.16	.16¼	.16	.16¼
650 S.R.	.18	.18¼	.18	.18¼
600 Pennsylvania flash	.19	.19¼	.19	.19¼
650 D filtered	.23¾	.24	.23¾	.24
600 E filtered	.19¼	.19½	.19¼	.19½
Pennsylvania Grade bright stock:				
No. 8 color, 145-50 at 210; 540-550 flash:				
10 pour test	.27½	.27¾	.27½	.27¾
15 pour test	.26	.26½	.26	.26½
25 pour test	.25¼	.25¾	.25	.25½

Wax and Petrolatum

(Prices per pound)

OKLAHOMA (Group 3)—	Oct. 24		Oct. 17	
124-126 white crude scale	.03¾		.03½	.03¾
PENNSYLVANIA—				
122-124	.0405		.03⅞	.04
124-126	.0410		.04⅛	
NEW YORK HARBOR—				
120-122 (a.m.p. basis)	.04	.0410	.04	.0410
124-126 yellow crude scale	.03⅞	.04⅛		
125-127	.0430	.0435	.04¼	.0480
130-132	.0465	.0470	.0465	
133-135	.0530		.0530	
135-137	.0555		.0555	
Petrolatum in barrels in carload lots:				
Dark green	.01⅝		.01⅝	
Amber	.02¼	.02½	.02¼	.02½
Extra amber	.02⅜		.02⅜	
Lily white	.06	.06¼	.06	.06¼
Snow white	.07	.07¼	.07	.07¼
Cream	.04¼	.05	.04¼	.05
CHICAGO (f.o.b. switching district)*—				
122-124	.0440	.0450	.0440	.0450
125-127	.0465	.0475	.0465	.0475
127-129	.0480	.0490	.0480	.0490
130-132	.0540	.0550	.0540	.0550
132-134	.0565	.0575	.0565	.0575

*Cents per pound on carlot orders in burlap bags of 225 lbs. approx. Add 3° F. a.m.p.

Export Prices

GASOLINE

GULF COAST—	Oct. 24		Oct. 17	
U. S. Motor	.05½		.05½	.05⅝
61-62 400	.05⅝		.05⅝	.05¾
61-63 390	.05⅞		.05¾	.05⅞
64-66 375	.06		.06	
LOS ANGELES, CALIF.—				
U. S. Motor grades:				
53-55 octane	.04½	.05	.04½	.05
55-65 octane	.05	.05¼	.05	.05¼
65-67 octane	.05½	.06	.05½	.06
67-69 octane	.06¼	.06¾	.06¼	.06¾
Above 69 octane	.07	.08	.07	.08
58-60 400 endpoint	.05¼	.06¼	.05¼	.06¼
KEROSENE				
GULF COAST—				
41-43 prime white	.04⅛	.04¼	.04¼	.04¼
41 water white	.04¼	.04⅜	.04¼	.04⅜
LOS ANGELES, CALIF.—				
41-43 water white	.03¾	.04¼	.03¾	.04¼
LUBRICANTS				
NEW YORK (f.a.s. in bbls.)—				
600 Warren E	.25½	.26½	.27¼	
600 S.R. unfiltered	.23	.24	.24	
650 S.R. unfiltered	.25	.26	.26	
600 flash S.R.	.26	.27	.27	
630 flash S.R.	.30	.31	.31⅝	
Bright stock, No. 8 color	.31½	.33	.33	
Bright stock, No. 6½ color, dil.	.30½	.31½	.32½	
NEUTRALS				
NEW YORK—Pale Engine Oil, Bulk (vis. at 100)—				
100-2¼	.07½	.08	.06½	.06¾
180-3¼	.12	.13	.12	.12½
230-3¾	.13	.14	.13	.13½
Red Engine Oil, Bulk (vis. at 100):				
200-6	.07½	.08½	.08½	.08¾
250-6	.08	.08¾	.08¾	.09¼
300-6½	.09	.09½	.09	.10
PARAFFIN WAX (Fully Refined)				
NEW YORK (prices per pound)—				
123-125 a.m.p.	.04½		.04½	.04¼
125-127 a.m.p.	.04¼	.04⅜	.04¼	.04⅜
130-132 a.m.p.	.04⅜		.04¾	.04½
133-135 a.m.p.	.05¼		.05¼	.05⅜
135-137 a.m.p.	.05½		.05½	.05⅝

Crude Oil Prices

Oklahoma, Kansas, North Central and East Central Texas

East Texas	$1.00
Stratman, Kans. (Sept. 29, 1933)	1.08
Corsicana (heavy) (June 17, 1933)*	.30
Other fields	(See gravity table)

Note—In East Texas, effective September 29, 1933, by Texas Co., Stanolind Crude Oil Purchasing Co., Humble Oil & Refining Co., Shell Petroleum Corp., Gulf Pipe Line Co., Tide Water Oil Co., Sinclair Prairie Oil Marketing Co., Magnolia Petroleum Co., Sun Oil Co., Panola Pipe Line Co. and Empire Oil & Refining Co.

*Magnolia Petroleum Co. †Eldorado Refining Co.

West Texas

Crane, Upton, Crockett, Howard, Glasscock, Mitchell (Sept. 29, 1933)	$.75
Ector, Winkler and Pecos Counties and Lea County, New Mexico (Sept. 29, 1933)	.70
Pecos County, Yates shallow pool (Sept. 29, 1933)*	.65
Jones and Fisher Counties	See gravity table

Note—Effective September 29, 1933, by Humble Oil & Refining Co., Texas Co., Gulf Pipe Line Co., Shell Petroleum Corp., Magnolia Petroleum Co., and by Stanolind Oil & Gas Co. in Winkler County, Texas.

*Shell Petroleum Corp.

Gulf Coast

Grade A and Grade B specifications discontinued by leading buyers	(See gravity table)
Tomball (see note)*	$1.15
Livingston (Sept. 29, 1933)†	1.00
Greta (Sept. 29, 1933)	.85
Refugio, light	(See gravity table)
Refugio, heavy (Sept. 29, 1933)‡	.85
Markham and High Island	(See Gulf Coast gravity table)
Conroe	(See Conroe gravity table)

Note—Tomball, effective September 29, by Humble Oil & Refining Co., and October 2 by Magnolia Petroleum Co.

*Greta posted by Texas Co. †Shell Petroleum Corp. ‡Refugio heavy, by Humble Oil & Refining Co.

South Central and Southwest Texas

(See note below table)

Darst Creek	$.87
Mirando	.80
Luling (Sept. 29, 1933)	.75
Pettus	1.05
Salt Flat	.87
Lytton Springs (Sept. 29, 1933)	.95
Duval County (Sept. 29, 1933)	.80
Saxet	.85

Note—Effective on September 29 by Humble Oil & Refining Co. in Darst Creek, Mirando, Pettus, Salt Flat and Saxet. Effective September 29 in Darst Creek by Gulf Pipe Line Co. and Texas Co. Effective October 2 by Magnolia Petroleum Co. Effective in Pettus and Salt Flat on September 29 by Humble Oil & Refining Co. and Gulf Pipe Line Co. Luling and Lytton Springs by Magnolia Petroleum Co. Duval County by Texas Co. Saxet, effective September 29, by Humble Oil & Refining Co. and Texas Co. Effective September 29 in Salt Flat by Shell Petroleum Corp.

Rocky Mountain States

Elk, light (Sept. 29, 1933)	$.96
Elk, heavy (Sept. 29, 1933)	.90
Florence, Colo. (June 17, 1933)	.30
Fort Collins and Wellington, Colo. (June 17)	(See Salt Creek prices)
Big Muddy (Sept. 29, 1933)	1.01
Frannie, light (Sept. 29, 1933)	.87
Frannie, heavy (Sept. 29, 1933)	.62
Salt Creek and La Barge (Sept. 9, 1933)	See Stanolind Mid-Continent price schedule
Grass Creek, light (Sept. 29, 1933)	1.18
Grass Creek, heavy (Dec. 15, 1932)	.45
Elk Basin (Sept. 29, 1933)	1.18
Rock Creek (Sept. 29, 1933)	1.02
Dutton Creek (July 6, 1933)	See Mid-Continent gravity prices

(Continued on Page 47)

Crude Oil Gravity Table

Degrees gravity—	Oklahoma and Kansas	North Texas, Central Texas and East Central Texas	North Louisiana and Arkansas	Gray County, Texas	Carson, Hutchinson and Moore Counties, Texas	Conroe, Texas	Salt Creek, Wyo.	Gulf Coast, Texas and Louisiana	Gulf Coast, Texas and Louisiana	Caddo, Louisiana	Sabine-DeSoto, Louisiana	Homer, Louisiana	Sarepta-Carterville, Louisiana	El Dorado, Arkansas	Haynesville, Louisiana	Miller County, Arkansas	Cotton Valley, Louisiana
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Below 20	....	....	....	....	....	....	....	$.82	$.82	....	....	....	....	....	....	....	....
20-20.9	....	....	....	....	....	....	....	.84	.84	....	....	....	....	....	....	....	....
21-21.9	....	....	....	....	....	....	....	.86	.86	....	....	....	....	....	....	....	....
22-22.9	....	....	....	....	....	....	....	.88	.88	....	....	....	....	....	....	....	....
23-23.9	....	....	....	....	....	....	....	.90	.90	....	....	....	....	....	....	....	....
24-24.9	....	....	....	....	....	....	....	.92	.92	....	....	....	....	....	....	....	....
Below 25	*$.76	....	....	....	....	....	....	....	....	$.63	$.69	$.71	$.75	$.75	$.65	$.62	$.70
25-25.9	*.78	....	....	....	....	....	....	.94	.94	.65	.71	.73	.77	.77	.67	.64	.72
26-26.9	*.80	....	....	....	....	....	....	.96	.96	.67	.73	.75	.79	.79	.69	.66	.74
27-27.9	*.82	....	....	....	....	....	....	.98	.98	.69	.75	.77	.81	.81	.71	.68	.76
28-28.9	*.84	....	....	....	....	....	....	1.00	1.00	.71	.77	.79	.83	.83	.73	.70	.78
Below 29	.84	$.79	$.79	....	....	....	$.84	....	....	....	....	....	....	....	....	....	....
29-29.9	.86	.81	.81	....	....	....	.86	1.02	1.02	.73	.79	.81	.85	.85	.75	.72	.80
30-30.9	.88	.83	.83	....	....	....	.88	1.04	1.04	.75	.81	.83	.87	.87	.77	.74	.82
31-31.9	.90	.85	.85	....	....	....	.90	1.06	1.05	.77	.83	.85	.89	.89	.79	.76	.84
32-32.9	.92	.87	.87	....	....	....	.92	1.08	1.06	.79	.85	.87	.91	.91	.81	.78	.86
33-33.9	.94	.89	.89	....	....	....	.94	1.10	1.07	.81	.87	.89	.93	.93	.83	.80	.88
34-34.9	.96	.91	.91	....	....	....	.96	1.12	1.08	.83	.89	.91	.95	.95	.85	.82	.90
Below 35	....	....	....	$.79	$.69	....	....	....	....	....	....	....	....	....	....	....	....
35-35.9	.98	.93	.93	.81	.71	$1.09	.98	1.12	1.09	.85	.91	.93	.97	.97	.87	.84	.93
36-36.9	1.00	.95	.95	.83	.73	1.11	1.00	1.12	1.10	.87	.93	.95	.99	.99	.89	.86	.94
37-37.9	1.02	.97	.97	.85	.75	1.13	1.02	1.12	1.11	.89	.95	.97	1.01	1.01	.91	.88	.96
38-38.9	1.04	.99	.99	.87	.77	1.15	1.04	1.12	1.12	.91	.97	.99	1.03	1.03	.93	.90	.98
39-39.9	1.06	1.01	1.01	.89	.79	1.17	1.06	1.12	1.13	.93	.99	1.01	1.05	1.05	.95	.92	1.00
40 and over	1.08	1.03	1.03	.91	.81	1.19	1.08	1.12	1.14	.95	1.01	1.03	1.07	1.07	.97	.94	1.02

*The following companies purchasing crude oil in Kansas or Oklahoma, or both, begin their price schedules: Below 25 degrees, 76 cents; 25-25.9 degrees, 78 cents, with 2 cents added for each degree upward to 40 and over at $1.08: Carter Oil Co., Magnolia Petroleum Co., Pure Oil Co., Rock Island Refining Co., Shell Petroleum Corp., Sinclair Prairie Oil Marketing Co., Skelly Oil Co. and Wilcox Oil & Gas Co. All others begin their schedule at below 29 degrees, 84 cents, excepting Phillex Oil Co. which begins with below 31 degrees at 88 cents.

Column 1—Effective September 29, The Texas Co. in Oklahoma, Stanolind Crude Oil Purchasing Co. in Kansas and Oklahoma; Anderson & Prichard, Inc., in Oklahoma; Bell Oil & Gas Co. in Oklahoma; Carter Oil Co. in Oklahoma and Kansas; Deep Rock Oil Co. in Oklahoma; Derby Oil Co. in Kansas; Globe Refining Co. in Oklahoma; Golden Rule Refining Co. in Kansas; Gypsy Oil Co. in Oklahoma and Kansas; Kanotex Refining Co. in Kansas; Magnolia Petroleum Co. in Oklahoma; Mid-Continent Petroleum Corp. in Oklahoma; National Refining Co. in Kansas and Oklahoma; Shell Petroleum Corp. in Kansas and Oklahoma; Sinclair Prairie Oil Marketing Co. in Kansas and Oklahoma; The Texas Co. in Oklahoma; Tide Water Oil Co. in Oklahoma; Vickers Refining Co. in Kansas; Continental Oil Co. in Kansas and Oklahoma; Empire Pipe Line Co. in Oklahoma and Kansas; Phillex Oil Co. in Kansas and Oklahoma; Pure Oil Co. in Oklahoma; Skelly Oil Co. in Kansas. Effective September 29, by White Eagle Oil Corp. in Kansas; on October 1 by Barnsdall Refineries, Inc., in Oklahoma.

Column 2—Effective September 29, by the Texas Co., Stanolind Crude Oil Purchasing Co., Humble Oil & Refining Co., Sinclair Prairie Oil Marketing Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Bell Oil & Gas Co., Continental Oil Co. Effective September 29 in the Van Pool, Van Zandt County, the Pure Oil Co. posted below 29 degrees, 84 cents, with 2 cents added for each degree up to 40 and over at $1.08.

Column 3—Effective September 29 by the Texas Co., Magnolia Petroleum Co., Gulf Refining Co. Effective September 29, Stanolind Oil & Gas Co. in Pine Island, Louisiana, and Marion County, Texas, posted below 25 degrees, 63 cents, with 2 cents added for each degree up to 40 and over at 95 cents. For Standard Oil Co. of Louisiana's prices see Columns 10 to 16, inclusive.

Column 4—Effective September 29 by the Texas Co., Humble Oil & Refining Co., Magnolia Petroleum Co., Sinclair Prairie Oil Marketing Co. and H. F. Wilcox Oil & Gas Co. On same day Phillex Oil Co. posted below 31 degrees, 71 cents, with 2 cents added for each degree up to 40 and over at 91 cents.

Column 5—Effective September 29 by the Texas Co., Humble Oil & Refining Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Wilcox Oil & Gas Co., Continental Oil Co. On same day, Phillex Oil Co. posted below 31 degrees, 61 cents, with 2 cents added for each degree upward to 40 and over at 81 cents.

Column 6—Effective September 29 by the Humble Oil & Refining Co. and Tide Water Oil Co., and on September 30 by the Texas Co. which on September 29 had posted a schedule of $1.07 to $1.12, with a 1-cent spread on each degree.

Column 7—Effective September 29 by the Stanolind Oil & Gas Co.

Column 8—Effective September 29 by the Humble Oil & Refining Co., Gulf Pipe Line Co., Shell Petroleum Corp., Pure Oil Co., Sinclair Prairie Oil Marketing Co. On October 2, Magnolia Petroleum Co. posted Lockport, Louisiana: 29-29.9 degrees, 84 cents, with 2 cents added for each degree upward to 34 and over at $1.12, and in Cameron Meadows and Iowa, Louisiana: Below 29 degrees, 72 cents, with 2 cents added for each degree up to 34 and over at $1.02. These were ½ cents higher on each degree than Magnolia prices posted on September 29. Effective September 29, Shell Petroleum Corp. posted in Iowa, Louisiana, district: Below 29 degrees, 70 cents, with 2 cents added for each degree upward to 34 degrees and over at $1.06; and in Black Bayou and White Castle, Louisiana: Below 30 degrees, 80 cents, with 2 cents added for each degree upward to 34 degrees and over at $1.10.

Column 9—Effective September 30, the Texas Co. (On September 29, the Texas Co. had posted a schedule 2 cents lower on each degree, but changed it on September 30.)

Columns 10, 11, 12, 13, 14, 15, 16—Effective September 29, by the Standard Oil Co. of Louisiana and Louisiana Oil Refining Co.

Column 17—Effective September 29, by the Louisiana Oil Refining Co.

(California Crude Oil Prices on Page 47)

TANK WAGON MARKETS

Quotations for gasoline and kerosene in United States, as furnished by the larger marketing concerns, include taxes

October 24, 1933

Taxes

The gasoline quotations given in the following tables include the 1½-cent Federal tax effective June 17, 1933, as well as state, county and city taxes. The gasoline quoted is the regular or standard grade. In most marketing areas a third or competitive grade is available at 1 or more cents per gallon under the service station price for the regular grade. Ethyl Gasolines are sold 1 cents above the service station price for the regular grade.

Southern District

STANDARD OIL CO. OF KENTUCKY

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Atlanta, Ga.	22.0	22.0	7.5	14.0
Augusta	22.0	22.0	7.5	14.0
Macon	22.0	22.0	7.5	14.0
Savannah	22.0	22.0	7.5	14.0
Birm'ham, Ala.	24.0	24.0	8.5	13.5
Mobile	23.0	23.0	8.5	12.5
Montgomery	25.0	25.0	8.5	14.5
Jackson, Miss.	22.0	22.0	7.5	13.0
Vicksburg	20.5	20.5	7.5	13.0
Jack'ville, Fla.	22.0	22.0	8.5	13.5
Miami	22.0	22.0	8.5	13.5
Pensacola	20.0	20.0	8.5	13.5
Tampa	22.0	22.0	8.5	12.5
Lexington, Ky.	19.0	19.0	6.5	11.0
Covington	21.0	21.0	6.5	11.0
Louisville	19.0	19.0	6.5	11.0
Paducah	19.5	19.5	6.5	11.0

In addition to the state tax of 4 cents on gasoline, Montgomery has city and county tax of 2½ cents on gasoline and one-half cent on kerosene. Kerosene prices in Georgia and Mississippi include 1-cent state tax. In Florida, an inspection fee of 0.125 cent; in Alabama, an inspection fee of one-half cent on kerosene and one-fortieth cent on gasoline. To Pensacola, Mobile and Birmingham state taxes on gasoline add 1-cent city tax.

Southwestern District

MAGNOLIA PETROLEUM CO.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Dallas, Tex.	16.5	19.5	5.5	8.5
Fort Worth	16.5	19.5	5.5	8.5
Houston	15 5	18.5	5.5	8 5
San Antonio	16.5	19.5	5.5	8.5
El Paso	17.0	20.0	5 5	8 5
Texarkana	*19.5	19 5	5.5	8.5
Muskogee	16.0	18.5	5 5	8 5
Okla. City	16.0	18.5	5 5	8 5
Tulsa	16 0	18.5	5 5	8 5
Ft. Smith Ark.	*17.9	17.9	5.5	9.0
Little Rock	*20.4	20.4	7.5	9.0

*Less 3 cents to dealers.

Standard Oil Co. (Indiana)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Chicago	17.8	17.8	4.5	5.7
Decatur, Ill.	18.2	18.2	4.5	10.2
E. St. Louis	17.5	16.7	4.5	9.5
Joliet	18.2	18.2	4.5	10.2
Peoria	18.2	18.2	4.5	10.2
Quincy	15.8	15.8	4.5	10.0
Davenport, Ia.	18.1	18.1	4.5	10.1
Des Moines	18.1	18.1	4.5	9.0
Mason City	18.1	18.1	4.5	10.1
Sioux City	17.7	17.7	4.5	9.7
Duluth, Minn.	18.7	18.7	4.5	10.4
Mankato	18.3	18.3	4.5	10.3
Minneapolis	18.4	18.4	4.5	10.4
LaCrosse, Wis.	19.8	19.8	5.3	10.9
Green Bay	19.2	19.2	5.5	10.2
Milwaukee	18.7	18.7	5.5	9.7
Madison	18.9	18.9	5.5	9.9
Detroit, Mich.	18.0	18.0	4.5	10.5
Grand Rapids	18.2	18.2	4.5	10.2
Saginaw	18.5	18.5	4.5	10.5
Evansville, Ind.	19.0	17.5	5.5	10.0
Indianapolis	19.2	19.2	5.5	10.2
South Bend	19.5	19.5	5.5	10.5
Fargo, N. Dak.	20.1	20.1	4.5	13.1
Huron, S. Dak.	20.4	20.4	5.5	11.4
Sioux Falls	19.9	19.9	5.5	10.9
K. C., Mo.*	17.2	17.2	4.5	7.5
Springfield*	17.1	17.1	4.5	9.1
St. Louis	16.2	16.2	4.0	8.7
St. Joseph†	16.8	16 8	4.5	8.5
Wichita, Kans.	16.1	16.1	4.5	8.1
Bartlesville, Ok.	16.5	17.0	5.5	9.5

*State tax 3 cents, 1-cent city tax and 1½-cent Federal tax.

Effective June 1, 1933—Discounts off tank wagon price to consumers on 500 gallons or more per month in territory outside of Chicago metropolitan area: 2 cents on Ethyl and Red Crown gasolines, and 1 cent on Stanolind gasoline. One-half cent additional discount in Chicago division.

Effective July 1, 1933—Discounts on resellers authorized agent's agreement made off the service station price throughout the territory as follows: 3.5 cents on Red Crown Ethyl and Standard Red Crown gasolines and 1.5 cents on Stanolind gasoline. Half of reduction from normal service station price shall be absorbed by resellers up to maximum of 1 cent on all grades.

Stanolex Furnace Oil in Chicago

Effective September 13, 1933, prices f.o.b. Chicago, tank wagon prices: No. 1 (36-40 lt. stw. zero), under 100 gallons, 8¼ cents; No. 2 (30-34 stw zero), 7¾ cents; No. 3 (22-26 zero), 7¼ cents; No. 4 under 300 gallons (12-16 zero), 6¼ cents; viscosity of No. 4, 90-115 at 100° F.; No. 5 under 300 gallons, 6 cents; for deliveries of 100 gallons or more deduct 1 cent.

Naphtha

	Tank	
	Wagon	Car
Oleum spirits	11.9	7.69
V.M.&P. naphtha	15.9	8.44
Cleaners' naphtha	15.0	8.94
Stanisol	15.0	8.19

Prices f.o.b. Chicago, September 13, 1933. Each of above prices subject to discount of 1 cent per gallon for 150-gallon lots if covered by contracts.

Atlantic Coast District

STANDARD OIL CO. OF NEW JERSEY

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Atl'tic City, N.J.	19.2	18.7	4.5	10.0
Newark	18.5	18.0	4.5	9.5
Annapolis, Md.	19.8	19.3	5.5	10.0
Baltimore	19.2	18.8	5.5	9.0
Cumberland	20.8	20.3	5.5	12.7
Wash'g'n, D. C.	17.5	17.0	3.5	11.0
Danville, Va.	21.9	21.4	6.5	12.9
Norfolk	20.4	19.9	6.5	11.3
Petersburg	21.2	20.7	6.5	11.4
Richmond	20.8	20.3	6.5	11.7
Roanoke	22.0	21.5	6 5	12.9
Charla'n, W.Va.	20.2	19.7	5.5	12.6
Parkersburg	19.5	16.5	5.5	11.2
Wheeling	20.2	19.0	5.5	12.2
Charlotte, N. C.	22.6	23.1	7.5	13.5
Hickory	23.9	23.4	7.5	13.7
Mt. Airy	23.9	23.4	7.5	13.8
Raleigh	23.4	23.9	7.5	13.3
Salisbury	23.7	23.2	7.5	13.6
Charleston, S.C.	21.4	20.9	7.5	11.3
Columbia	23.2	22.7	7.5	13.2
Spartanburg	23.6	23.1	7.5	13.5

Note—Dealer contracts for gasoline are written at 2½ cents over the posted tank car price. Kerosene 1 cent off tank wagon for 25 gallons or more under contract except New Jersey and Baltimore, Md.

Central South District

STANDARD OIL CO. OF LOUISIANA

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
N. Orleans, La.	20 8	20 8	*7 5	†12.0
Baton Rouge	20 0	19 5	6.5	†12 0
Alexandria	20.9	20.4	*7.5	†12 0
Lafayette	21.1	20.6	*7 5	†12.0
Lake Charles	21 0	20 5	*7 5	†12 0
Shreveport	18 8	18.3	6 5	†12 0
Knoxville, Tenn.	24.2	23.2	8 5	13.5
Memphis	22.6	22.1	8.5	11.0
Chattanooga	23.9	22.9	8.5	12.0
Nashville	23.5	22.5	8.5	11.0
Bristol	24.1	23.1	8.5	14.0

*Includes city tax of 1 cent. †Louisiana kerosene prices include 1-cent state tax.

Effective June 2, 1933, station prices fixed at 7 cents above basic tank car price at key refining points in territory. Commercial consumers for tank wagon delivery pay following amounts over tank car price basis yearly deliveries:

1,000 to 75,000 gallons	2.5
75,000 to 300,000 gallons	1.5
Over 300,000 gallons	1.0

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA*

	Gasoline			Kero.
	Tank truck†	Posted retail	Incl'ds tax	tank wagon
San Francisco	17.0	20.0	4.5	12.5
Los Angeles	16.5	19.5	4.5	12.5
Fresno, Calif.	18.0	21.0	4.5	14.0
Reno, Nev.	20.5	23.5	5.5	15.5
Phoen'x, Ariz.	18.5	21.5	6.5	‡16.0
Portland, Ore.	19.5	22.5	6.5	13 5
Seattle, Wash.	19.5	22.5	6.5	13.5
Tacoma	19.5	22.5	6.5	13.5
Spokane	22.5	25.5	6.5	16.0

*Retail prices posted by Standard Stations, Inc., a subsidiary.

†Above prices are at company's plant or depots as company does not operate stations. A 4-cent per gallon discount is given dealers and customers taking tank wagon lots except in Phoenix where the discount is 1 cent. ‡Includes 6-cent state tax.

New York and Part of New England District

STANDARD OIL CO. OF NEW YORK

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Albany, N. Y.	17.1	18.1	4.5	9.5
New York	17.0	18.0	4.5	8 5
Buffalo	17.7	18.7	4.5	9.5
Rochester	17.8	18.8	4.5	9.5
Syracuse	17.6	18.6	4.5	9.0
Boston, Mass.	17.0	18.0	4.5	8.5
Augusta, Me.	18.5	19.5	5.5	9.0
Manch'tr, N. H.	19.2	20.2	8.5	8.5
Burlington, Vt.	19.8	20.8	5.5	9.0

Pennsylvania, Delaware and Part of New England

ATLANTIC REFINING CO.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Philadelphia, Pa.	14.5	15.0	4 5	10.0
Pittsburgh	17.0	18.0	4.5	10.0
Allentown	17.0	18.0	4.5	10.0
Erie	17.0	18.0	4.5	10.0
Scranton	17.0	18.0	4.5	10.0
Altoona	17.0	18.0	4.5	10.0
Dover, Del.	17.0	18.0	4.5	10.0
Wilmington	15.0	15.0	4.5	10.0
Boston, Mass.	17.0	18 0	4.5	8.5
Springfield	17.6	18 6	4.5	8.5
Worcester	17.5	18.5	4.5	8.5
Hartford, Conn.	16 4	17.4	3.5	8.5
New Haven	16 2	17.2	3.5	8.5
Providence, R.I.	16.0	17.0	3.5	8.5

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Denver, Colo.	19.0	21.5	5.5	12.5
Pueblo	19 0	21 5	5 5	13 0
Grand Juctn.	21.0	23.5	5.5	15.0
Casper, Wyo.	19.5	22.0	5.5	11.0
Cheyenne	18.0	20.5	5.5	13.0
Butte, Mont.	21 0	23 5	5 5	17 5
Billings	23.0	25.5	6.5	16.5
Helena	23.0	25.5	6.5	17.5
Great Falls	22.5	25.0	6.5	17.5
Salt Lake, Utah	22 0	24.5	5 5	16 0
Boise, Idaho	23.0	25.5	6.5	18.0
Twin Falls	23.0	25.5	6.5	18.0
Albu'que, N. M.	19.5	22.5	*7.5	13.0

*One-cent city tax.

Effective June 1, 1933, dealers and lease and license accounts will receive 2½ cents discount on regular gasoline in Montana, Colorado, Wyoming, Utah and Idaho.

Ohio

STANDARD OIL CO. OF OHIO

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Ohio points	17.0	18.0	5.5	*12.5

*Includes state tax of 1 cent, effective July 22.

Canada*

IMPERIAL OIL, LTD.
Imperial 3-Star Gasoline

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Hamilton, Ont.†	26.5	27 5	6 0	17.5
Toronto, Ont.†	26 5	27.5	6.0	17.5
Brandon, Man.*	31.0	34 5	7.0	23.5
Winnipeg, Man.	28.0	31.5	7.0	19.5
Regina, Sask.	31 0	35 0	6.0	23.5
Saskatoon, Sask.	33.0	37.0	6.0	25.5
Edmonton, Alta.	31.5	35.5	6.0	24.5
Calgary, Alta.	28.0	32 0	6.0	21.0
Vanc'ver, B. C.†	30.0	31.0	7.0	24.0
Montreal, Que.	24 0	27 0	6.0	17.5
St. Johns, N. B.	26 5	30.5	7.0	21.0
Halifax, N. S.	25.5	29.5	6.0	21.0

*Imperial gallon used in Canada. †Dealer discount posted tank wagon on gasoline in Ontario and British Columbia subject to dealer's discount of 3 cents per gallon.

Nebraska

STANDARD OIL CO. OF NEBRASKA

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax	tank wagon
Omaha	18.3	19.3	5.5	10.3
McCook	18.4	18.4	5.5	10.0
Norfolk	19.3	20 3	6 5	11.3
N. Platte	20.3	21 3	5.5	10.5
Scottsbluff	19.3	19.3	5.5	11.0

Note: Discount to dealers and AAA commissions. From service station price: Red Crown Ethyl and Standard Red Crown gasoline, 3 cents. Reliance (third grade) gasoline, 2 cents. Rentals under lease and agents agreement, one-half cent per gallon additional.

Discount to consumers under contracts (large consumers under contracts and governmental units): On tank wagon deliveries of gasoline on monthly purchases of 500 gallons, or yearly purchases of 6,000 gallons, from the service station price: Red Crown Ethyl and Standard Red Crown Gasoline, 2 cents per gallon; Reliance (third brand) gasoline, 1 cent per gallon.

Retail Price Changes

Regular-Grade Gasoline and Kerosene

Standard Oil Co. of New Jersey October 7 advanced the service station price of gasoline one-tenth cent in Chattanooga. October 9 it advanced the tank wagon price of kerosene 1 cent in Tennessee. October 12 it reduced the service station price of gasoline six-tenths cent in Chattanooga, one-half cent in Knoxville and Nashville, and 2½ cents in Roanoke. October 13 it reduced the service station price of gasoline 2½ cents in Parkersburg. On the same date it reduced the tank wagon price of kerosene 1 cent in Petersburg. On October 17 it advanced the service station price of gasoline 2½ cents in Roanoke.

Atlantic Refining Co. October 15 reduced the tank wagon and service station price of gasoline 1 cent in Philadelphia. October 19 it made another reduction of 1 cent. October 17 it reduced the tank wagon price of gasoline 2 cents and the service station price 3 cents in Wilmington.

Standard Oil Co. of California October 19 reduced the tank wagon and service station prices of gasoline one-half cent in Reno, Portland, Seattle, Spokane, Tacoma, Fresno and San Francisco and advanced the price 2 cents in Los Angeles.

Standard Oil Co. of Nebraska October 19 advanced the tank wagon and service station prices of gasoline in McCook nine-tenths cent.

Magnolia Petroleum Co. September 26 reduced the tank wagon and service station prices of gasoline 1 cent in Houston. October 13 it reduced the prices 1 cent in Oklahoma City and Tulsa. October 18 it reduced the prices 1 cent in Muskogee.

Consumption of Gasoline in Canada Shows Advance

OTTAWA, Ontario, Oct. 23.—Official figures just issued show that sales of gasoline in Canada in July advanced to 56,490,000 gallons from the June total of 49,293,000 gallons. There was a gain over the July, 1932, total of 51,551,000 gallons. Comparative figures for the various provinces follow:

	July, 1933	July, 1932
Prince Edward Island	340,000	357,000
Nova Scotia	2,280,000	2,275,000
New Brunswick	1,757,000	1,800,000
Quebec	10,555,000	10,591,000
Ontario	25,829,000	22,037,000
Manitoba	3,014,000	2,915,000
Saskatchewan	3,858,000	3,451,000
Alberta	4,487,000	4,008,000
British Columbia	4,370,000	4,117,000

Imports of natural gasoline into Canada during July amounted to 1,619,847 gallons valued at $80,749 as compared with 3,878,771 gallons worth $151,084 imported in June. Gasoline lighter than .8235 specific gravity at 60-degree temperature imported in July totaled 857,610 gallons appraised at $92,495.

RUMANIANS SEEK CONCESSIONS

MONTREAL, Quebec, Oct. 23.—Capt. Ernest Dubuc, managing director of an organization of independent oil exporters, has announced that his organization is seeking a reduction of the present dumping duty of 9 cents a gallon on Rumanian gasoline. Representations will be made at the forthcoming inquiry into Canadian gasoline prices. In the last two years, according to Captain Dubuc, 6,000,000 gallons of Rumanian gasoline have been imported into Canada.

NEWS FOR SALES DEPARTMENTS

Marketers Cheerful Over Outlook for Oil Products

KANSAS CITY, Mo., Oct. 23.—Independent oil jobbers from Iowa, Kansas, Missouri and Nebraska holding their annual convention in the Hotel President here expressed optimism over the minimum price of $1.11 a barrel fixed by Secretary of the Interior Ickes for crude oil in the Mid-Continent Field.

George S. Allee, chairman of the Missouri Planning and Co-ordinating Committee, said the price would stabilize the industry, but it would send the retail price of gasoline up at least 2 cents a gallon, according to his computation. "Prices will have to come up all along the line," Mr. Allee said.

In Secretary Ickes' plan retailers of gasoline are assured a margin of 3 to 4 cents a gallon on the gasoline to be sold to motorists, the retailers' margin depending on the grade of gas.

One of the speakers on the program was B. L. Majewski, of Chicago, one of the 12 members of the National Planning and Co-ordinating Committee, which has been meeting in Washington.

Mr. Allee was re-elected president of the Missouri Oil Men's Association at a business session of the Missouri section of the four-state conference. Other officers of the Missouri association elected were Bert Bertram of Kansas City, treasurer, and the following vice presidents: W. T. Atkins, Kansas City; George Koertel, St. Louis; W. H. Simpson, Charleston; and John G. Gibson, Jefferson City.

Shell Leases Distribution Facilities From Old Dutch

MUSKEGON, Mich., Oct. 23.—The Old Dutch Refining Co. today announced a deal with the Shell Petroleum Corp. which will provide the latter with western Michigan storage and distributing headquarters for gasoline and other petroleum products. One 37,500-bbl. tank with facilities for unloading from lake tankers is leased to the Shell. Old Dutch is constructing a new loading platform near the tank in North Muskegon on the edge of the Muskegon oil field. The first boatload of gasoline is due here October 26. The tanker Mexoil left Saturday with a cargo of 16,500 bbls. of gas oil destined for Detroit from the Old Dutch company, which will continue using two 10,000-bbl. tanks for similar shipments of gas and fuel oil.

Right of Oklahoma to Tax Tank Car Fleet Contested

WASHINGTON, D. C., Oct. 23.—Oklahoma's right to tax a fleet of tank cars of the Johnson Oil & Refining Co., operating out of a refinery in Pawnee County, Oklahoma, and engaged in interstate commerce, was argued in the Supreme Court.

The fleet contains 385 tank cars, each visiting the refinery an average of once each 18 days. The company insisted these cars are taxed in 16 or 17 other states on a basis of proportionate use and Oklahoma could not legally tax all. It was conceded that should the Oklahoma legislature provide a tax on a proportionate share of the fleet operating in Oklahoma, the tax might be sustained.

Ed White Clark, counsel for Oklahoma and Pawnee County, contended all the cars had an abiding place in Oklahoma, each visiting the refinery when empty and that the State Supreme Court was correct in holding the tax imposed for 1925 to 1928, inclusive, was valid.

Merits of Road Oil in Highway Making Are Discussed at Annual Congress

The merits of road oil in the construction of secondary highways were discussed by well-known speakers at the third annual national road oil congress held Thursday and Friday, October 19 and 20, in the Mayo Hotel, Tulsa. At the Thursday forenoon session George J. Stein, of Miami, Okla., president of the congress, was introduced by Cyrus S. Avery, president of the Tulsa Chamber of Commerce.

"While we are not going to wreck the long accepted truth that what is worth doing is worth doing well, we are going to wreck the idea that it is necessary to spend $20,000 to $30,000 a mile to build roads of the secondary or intermediate type," said Mr. Stein.

"Oil is one of the major products of Oklahoma today, yet a comparatively small amount of it is on Oklahoma roads. It is interesting to note what a difference there is in the picture when we take a glance at some of our neighbor states that produce no oil.

"In 1932 Missouri used 14,000,000 gallons of road oil and has in her 1933 budget 6,400,000 gallons. On the state highway system alone the state has 880 miles of oil treated roads. In Minnesota the oil treated road mileage is 2,459 miles and during 1932 that state used 20,700,000 gallons of bituminous material. Their budget this year calls for 3,700,000 gallons."

Papers delivered before the congress included "Some Aspects of Road Oil Construction from the Materials Engineer's Viewpoint," by H. Allen, materials engineer, Kansas State Highway Department: "Asphalt Emulsions and Their Uses," by E. W. Mace, assistant chief chemist, Amuleo Asphalts; "Some Important Factors in Connection with Low Cost Roads," by J. T. Pauls, senior engineer of the U. S. Bureau of Public Roads, and "The Use of Retread Construction for Salvaging Oil Surfaced Highways," by F. S. Gilmore, assistant maintenance engineer, State Highway Department of Kansas.

PLANT LEASED BY TIDE WATER

HARTFORD, Conn., Oct. 23.—The Ballard Oil Co. has leased to the Tide Water Oil Co. its plant in Whethersfield for the delivery of Tide Water fuel oil products to all customers of the Ballard company. Included in the deal was the purchase by Tide Water of a six-acre tract of land adjoining its present bulk plant in Whethersfield. Orders for fuel oil will be accepted as heretofore at the office of the Ballard Oil Co. or at the Hartford office of Tide Water.

WESTERN OIL & FUEL CO. MOVES

The Western Oil & Fuel Co. of Minneapolis, Minn., has moved into its new plant and offices at 227 North Colfax Avenue. The company is well established in the wholesale and retail markets of Minnesota, Wisconsin, Iowa and the Dakotas.

HYGRADE BUYS BULK TERMINAL

The Hygrade Oil Co., Inc., Hartford, Conn., has purchased a large bulk terminal located on the Connecticut River at Rocky Hill. The purchase price is said to have been $250,000. The station has a capacity of 4,000,000 gallons with barge and railroad facilities. The purchase included two filling stations in Hartford. Morrs Krochevsky heads the company.

LOADING FOR ANTARCTIC TRIP

NEW YORK, Oct. 23.—The Jacob Rupert, 11,000-ton freighter flagship of Rear Admiral Richard E. Byrd, before sailing for the South Pole tied up at the Tide Water Oil Co.'s Bayonne, N. J., terminal and took on 2,000 tons of fuel oil, 1,200 drums of Tydol aviation gasoline for the expedition's planes and 400 tons of special Diesel oil, in addition to numerous other oils and greases.

Plans Made for Vigorous Enforcement of Marketing Code in Chicago Area

CHICAGO, Oct. 23.—Steps toward vigorous enforcement of code requirements in the Chicago area as they apply to marketing of petroleum products have been taken under a plan worked out by J. G. Sinclair, Shell Petroleum Corp., chairman of the city committee; T. B. Clifford, Standard Oil Co. (Indiana), vice chairman; and J. K. Skillings, Texas Co., secretary. The plan involves a network of zones, committees and advisers for special phases of the work.

Thirteen zones have been created, the district formed coinciding with the Chicago division territory of Standard Oil Co. (Indiana), from the Wisconsin state line on the north to a point east of the Indiana state line on the east and south. Within this area is declared to be the "worst marketing region" in the world.

For each zone a chairman will be responsible for all conditions pertaining to the oil industry in his zone. With the thought that every phase of the industry should be represented, the zone chairmen are chosen from various oil companies. These zone committee members are to give any assistance necessary in adjusting complaints, reporting violations, and generally assisting in other ways.

Each zone chairman is expected to attend every meeting called for the metropolitan committee. Proxies will not be permitted and members have been requested not to invite guests. If a zone chairman is unable to make satisfactory disposition of a case he will request the assistance of the special advisers.

W. J. Herr, Mid-Continent Petroleum Corp., will assist on questions pertaining to tank car shipments and jobbers; F. J. Moore, president of the Chicago Burning Oil Distributors Association, on burning oils; Charles E. Gauer, trackage service stations, especially those under independent operation; T. A. Telfer, Calumet Refining Co., compounding questions; and J. J. Elwell, Pennsylvania Oil Co., lubricating oil jobber problems.

Say Rate War Will Follow Truck-Railroad Decision

SAN FRANCISCO, Calif., Oct. 23.—In a 3 to 2 decision of the Railroad Commission, which dissenting members warned is likely to precipitate a rate war, seven railroads and a freight traffic bureau were given permission to cut present rates on oil transportation in California.

Losers by the decision are a group of truck operators who were denied permits to operate in the field, upon application.

The railroads' move to establish lower rates was designed, the commission announced, "to recapture to the rails a substantial portion of the petroleum transportation business, which in recent years has passed largely to trucking interests."

Winners by the decision are the Southern Pacific Co., the Atchison, Topeka & Santa Fe., the Los Angeles & Salt Lake Railroad, the Pacific Electric Railway Co., the Western Pacific, the Sacramento Northern, the Tidewater & Southern Railway and the Pacific Freight Tariff Bureau.

The majority opinion, written by Commissioners Clyde L. Seavey, W. J. Carr and M. B. Harris, held that the lower rates proposed by the railroads were "fully justified as compensatory." It explained that difficulty had been encountered in considering the applications for trucking permits because of duplications of service, but ruled that the trucking companies if they chose might seek for limited certificates which would carefully limit the sphere of their service.

The dissenting commissioners, Leon W. Whitsell and Wallace L. Ware, criticized the majority opinion as "not in harmony with the nation's recovery program."

"Reduced rates under the circumstances are nothing more than cut prices to stifle competition," they asserted in the minority report.

"The tank truck operators will not sit idly by and allow their facilities to deteriorate from lack of use, without attempting to meet the suspended rail rates. Thus respondents will be forced to again publish reduced rates. Experience has shown the disastrous effect of rate wars."

The majority opinion also commented on the probabilities of a rate war, declaring that if it should occur responsibility for it "must rest with the carriers and the oil companies."

Strike of Filling Station Men Is Declared Unlikely

NEW YORK, Oct. 23.—The threatened strike of 25,000 gasoline filling station attendants in New York and its suburbs by the new Gasoline Station Workers Union is not expected to become a reality according to employers.

Frederick F. McEnaney, president of the union, asserted that the men received as little as $10 to $22 a week and work hours ranging from 48 to 84 a week. The union demands a five-day, 40-hour week and adequate minimum wage scales to be formulated within the next few days for presentation to the employers.

An official of a leading oil company said representatives of the union had made no demands on any of the big oil companies, and that reports that service station workers were working long hours were without foundation. The oil companies, he said, are paying at least the minimum wage demanded by the NRA code, and in most instances more, and that none of the large companies worked their men more than 48 hours a week as prescribed by the oil code.

NEWS FOR PETROLEUM REFINERS

Code Helping Oil Industry According to Mr. Seubert

CHICAGO, Oct. 21.—The trend of developments in the oil industry has been encouraging since the oil code became effective, Edward G. Seubert, president of Standard Oil Co. (Indiana), told employe representatives and officials, meeting in the Congress Hotel in the company's fifteenth annual conference on industrial relations.

Mr. Seubert's address closed a day of discussion of the year's problems arising in employe relations in the company's refineries and general office. More than 100 representatives attended from plants in Whiting, Ind.; Sugar Creek, Mo.; Wood River, Ill.; Neodesha, Kan., and Casper and Greybull, Wyo.

"The code has brought the most serious attempt the industry has yet seen to operate in accordance with economic planning," Mr. Seubert said. "It is regulating production of crude oil to prevent wasteful creation of excess supplies. In marketing it is working against unsound practices which have been the bane of the industry for years. While it has brought some new complications to perplex us, I am hopeful that it will solve some of the major problems we have had to face heretofore."

In applying the code to his company's operations, Mr. Seubert announced, part-timing has been abandoned in refineries, working weeks have been shortened and jobs have been made, especially in the sales organization, for about 3,300 employes, involving an increase in pay roll payments of $5,000,000 a year.

Alcohol-Gasoline Mixture Is Being Advocated Again

CHICAGO, Oct. 23.—With the administration in Washington still confronted with the critical necessity for higher grain prices, to achieve which Secretary of Agriculture Wallace recently said calls for a "sympathetic re-examination of every remedy and each device, including those which orthodox economists would reject impatiently," the proposal again has been brought forward to blend grain alcohol with gasoline as an automobile fuel. Proponents of the mixture here say the oil companies, whose objections have been vigorous, might consent to a 3 per cent mixture of alcohol with gasoline instead of the 10 per cent mixture originally proposed.

Support for the alcohol-gasoline fuel finds influential adherents of the idea considering the distillation of alcohol from wheat a more logical aid to better grain prices than the original suggestion that surplus corn be utilized. "Sustain wheat prices," they say, "and this bellwether grain will bring up the price of other grains, and at the same time the pressing problem of consumption of our wheat surplus will be taken care of."

A mixture of 3 per cent gasoline, on the basis of an average annual domestic consumption of gasoline of 15,793,260,000 over the past five years, would require 473,798,000 gallons of grain alcohol. Average annual wheat surplus of 200,000,000 bushels would yield 500,000,000 gallons of alcohol.

SIX BURNED IN EXPLOSION

LONGVIEW, Tex., Oct. 21.—Six men were burned seriously, three perhaps fatally, as a result of two explosions Thursday in the refining plant of the Gregg-Tex Gasoline Corp., near here. The men were injured when a compressor, which manufactured gasoline from natural gas, blew up.

Parco Properties to Be Sold to Highest Bidder Under Federal Court Order

CHEYENNE, Wyo., Oct. 23.—Properties of the Producers & Refiners Corp., which has been in receivership since May, 1932, are to be sold at public auction in accordance with an order issued here by Federal Judge T. Blake Kennedy. The order will be followed by a formal decree, listing the properties to be sold. Judge Kennedy set the date of the sales between next March 15 and April 15.

The assets include refining, pipe line and producing companies in Wyoming, Colorado, Kansas, Texas and Oklahoma.

In extended hearings the Consolidated Oil Corp. has sought permission to buy the properties of the Producers & Refiners Corp. The Consolidated, which holds a claim of $14,000,000 against the Producers & Refiners, has contended operation of the Producers & Refiners properties under a receivership was not and could not be profitable. The claim of the Consolidated was represented in 10 notes given by the Producers & Refiners in amounts varying from $57,000 to $5,000,000 from 1926 to 1932.

Attorneys for stockholders' protective committee representing 7,000 shares of preferred stock of the Producers & Refiners fought the petition for an immediate sale on the grounds that expected improvement in the oil industry would greatly enhance the value of the company's properties. The stockholders' committee placed a potential value of $28,000,000 on the Producers & Refiners' assets, as against a $16,000,000 valuation by Consolidated.

Parco, as the Producers & Refiners Corp. is known, was incorporated in 1917 as a Wyoming corporation by Frank E. and William L. Kistler, both of Tulsa. It soon became one of the outstanding refineries of the Mid-Continent and Rocky Mountain areas. It became a subsidiary of Prairie Oil & Gas Co. and was slated for absorption with the Consolidated Oil Corp. when the receivership proceedings occurred.

The Prairie Oil & Gas Co. held 10 of its notes aggregating $14,000,000. These notes were acquired by the Consolidated when it took over the Prairie. The Consolidated petitioned the court to permit it to purchase the properties for $16,000,000 to satisfy its notes. The court upheld the validity of the Consolidated's claims as represented by the notes and ordered the sale to the highest bidder, setting the time sufficiently ahead to permit investigation of properties by prospective purchasers and to take advantage of any favorable change in conditions.

Assets of the company consist of a 10,000-bbl. skimming refinery at Parco, Wyo., a 7,000-bbl. skimming refinery at West Tulsa, Okla., which also possesses cracking equipment, and a 3,000-bbl. skimming refinery at Blackwell, Okla., that is idle, and a natural gasoline plant at Wertz, Wyo., 650,000 acres of leases in 12 states, 1,000 miles of pipe lines in Wyoming and Oklahoma and many tank cars, filling stations and bulk plants. Before the receivership its capitalization was 1,000,000 shares of $50 par common, of which 748,779 had been issued; 56,907 shares of preferred stock, also with par of $50, and all issued.

ALTITUDE ENLARGES REFINERY

CHANUTE, Kans., Oct. 23.—The Altitude Petroleum Corp. has let a contract to the Petroleum Engineers, Inc., affiliates of McKee & Co., for a new absorption plant at its Chanute refinery, equipped to make all grades of absorption gasoline principally from the cracked gases available at the refinery. The Altitude has been specializing in a bronze lubricated antiknock gasoline. Equipment is being added at the same time to increase the capacity of the refinery and improve the octane value of the gasoline made. This equipment is mostly in the form of special heat exchangers. Further extensions contemplated include new cooling towers and additional storage.

ROAD OIL REFINERY BURNED

ARTESIA, N. Mex., Oct. 23.—New Mexico Road Oil Co.'s refinery in Dayton, 8 miles south of Artesia, was destroyed by fire last week. The loss is estimated at $10,000 to $15,000. The plant had been operating on crude from the Getty Pool to supply road oil to the state highway department. The plant may be rebuilt on the Santa Fe spur track nearer the Getty Pool.

ROOSEVELT MAKING ADDITIONS

MT. PLEASANT, Mich., Oct. 23.—The Roosevelt Oil Co. is installing a new bubble tower and still at its Mount Pleasant refinery to replace equipment in use nearly three years. Daily output of the plant is not expected to be increased but efficiency is to be greater. The company has been maintaining an average pipe line run of 3,000 barrels of crude a day.

TEN CARS ON TESTING TOUR

A fleet of 10 stock automobiles equipped with scientific instruments to test the behavior of gasoline, oil and grease under a variety of climatic conditions, has started from Notikowin, in the Canadian Province of Alberta, and will tour this country following a short stay in New York. The motorcade, dubbed the "Under Three Flags Expedition," will cover more than 7,500 miles, running from the northernmost motor highway in Canada through many states down to the Pacific Ocean on the Mexican National Highway. The trip is sponsored by the Socony-Vacuum Corp.

FULL POWER AT ALL SPEEDS

A full spark advance adjustment which gives full power at all car speeds is possible with motor fuel containing tetraethyl lead, it is shown by experiments at the Detroit Engineering Laboratories of the Ethyl Gasoline Corp., owned jointly by General Motors Corp. and the Standard Oil Co. of New Jersey. When using ordinary motor fuel it was found necessary to retard the spark in lower speeds in order to avoid knocking. The advantage of the full spark advance, accomplished by completely releasing the distributor brake, is quicker acceleration from a low speed. Using tetraethyl lead, car speed was increased from 10 to 50 miles per hour in 1.05 seconds less time than with ordinary gasoline because the full spark advance curve was available at all speeds. The retarded spark, necessary at low speeds with ordinary fuels to avoid knocking, delays the car in reaching its maximum speed.

High Court Denies a Writ of Error to Gulf Company

AUSTIN, Tex., Oct. 23.—Giving title to a $1,150,000 oil property to the East Texas Refining Co. of Dallas, the Supreme Court in Austin denied an application of the Gulf Production Co. for a writ of error on appeal from the Court of Appeals in Texarkana.

The Supreme Court's decision turns over to the Dallas company a 309-acre lease in the Cordova Survey of Rusk County on which there are 25 producing wells and other developments. The land is estimated to be worth about $620,000, the wells to have cost about $500,000 more and other improvements making the property worth about $1,150,000.

Under the decision the holdings of the Rusk County District Court and the appeals court were upheld, giving title to the land to the East Texas company. Both companies obtained leases on it, and the Gulf developed the property. The East Texas concern, before taking possession, must settle with the Gulf as to the value of the wells, storage and gathering system on the property, against which will be balanced the value of the oil produced by the Gulf from a property finally decided to belong to the East Texas company.

The case has been in the courts for about two and one-half years.

Employes of Quaker State Get Insurance Protection

OIL CITY, Pa., Oct. 23.—Insurance protection has been provided for employes of the Quaker State Oil Refining Corp. and affiliated companies. The plan, which comprises group life insurance, accident and health insurance, accidental death and dismemberment insurance, and group pensions, will be underwritten and administered by the Equitable Life Assurance Society of the United States. The total volume of group insurance and pensions for approximately 700 employes is placed at more than $12,000,000.

Chief among the Quaker State's affiliated companies are the Quaker Oil Refining Co., James B. Berry Sons' Co., Inc., Sterling Oil Co., Enterprise Oil Co., and Ohio Valley Refining Co.

As a result of the plan, employes are protected by $1,500,000 of group life insurance, $780,000 of group accident and health insurance, and $1,400,000 of group accidental death and dismemberment insurance, while the volume of group pensions is estimated at $8,500,000.

An employe participating in the pension plan will receive upon retirement a life income computed on the basis of earnings and length of service after July 1, 1933, as well as all service, except the first five years, before that date. Employes normally will retire at 65 to 70 depending upon their age when entering the plan.

The amount of group life insurance for an individual employe is based upon earnings and is payable in the event of death from any cause.

NORTHWESTERN IS OPERATING

CHEYENNE, Wyo., Oct. 23.—Northwestern Petroleum Co., which has one of the oldest refineries in the Huerfano County Field, has resumed operations and posted prices for Osage crude. It offers $1.20 a barrel for 40 gravity and up; $1.15 for 39 gravity, and reduces the price 5 cents a barrel for each degree of gravity down to 90 cents for crude of 34 gravity. This schedule is expected to be followed by other skimming plants.

NATURAL GASOLINE MANUFACTURE

Natural Not Mentioned in Price Fixing Schedule

In the rather detailed announcement a week ago by Secretary Ickes in regard to the Federal program of oil price fixing, no reference was made to natural gasoline.

While many questions can arise because of the absence of specific mention of natural gasoline prices, it may be stated with certainty that manufacturers will continue to follow the spirit of the code and the orders of the administrator and will not attempt to take advantage of the omission.

The price-fixing order was designed to bring crude prices and refinery prices up to the level where these major groups could show a reasonable profit from operation. Also, it is very likely that when these two major branches are on a profitable working basis the natural gasoline branch will be also.

The largest consumer of natural gasoline continues to be the refiner and so the problem of fixing prices becomes sort of a family affair. Of the total volume of motor fuel made, only about 7 per cent of it originates as natural gasoline. This relatively small volume can be readily absorbed by refiners when the natural gasoline price is relatively low and if the natural gasoline manufacturer becomes dissatisfied with the price the refiner is willing to pay, he is now in a position to stabilize his production and sell it as a high quality motor fuel in direct competition with refinery gasoline.

As an example, an 11 or 15-pound natural gasoline sold as a motor fuel after December 1 will need to take the price of refinery gasoline as fixed by the administrator. These prices have been based upon the octane rating of the material. So, for the first time, natural gasoline of this quality will be graded and priced according to its octane rating rather than volatility, vapor pressure, etc. For convenience the prices announced for gasoline for December 1 are tabulated here:

	Minimum
65 to 70 octane	.07
64 to 64.9 octane	.06½
50 to 59.9 octane	.06
Under 50 octane	.05½

In the face of no more definite ruling on the matter, it is assumed that natural gasoline will continue to be traded between refiner and manufacturer much as has been the practice in the past.

With a definite price for motor fuel established, a rather definite price may be calculated for the 26-70 and other grades if desired. If manufacturers adhere to the percentage method of calculating prices as has been practiced in part for the past two years, it will be easy to correlate prices, sales and production. However, if no percentage price rule is mutually adopted, there may be a question as to the position of a jobber who buys natural gasoline and refinery gasoline for blending at his plant. Under a loose interpretation of the price-fixing arrangement thus far, it is within reason to assume that a jobber could purchase 26-70 natural for 3 cents at some time this winter when regular U. S. Motor gasoline was worth 6½ cents and the tendency would be to load as much natural into the blend as weather conditions would stand. Obviously this would tend to defeat the program of the administration if this should become the general practice, the increased demand for natural would be so pronounced as to bring about a rapid advance in prices again, but certainly the price-fixing arrangement does not eliminate the possibility of this happening.

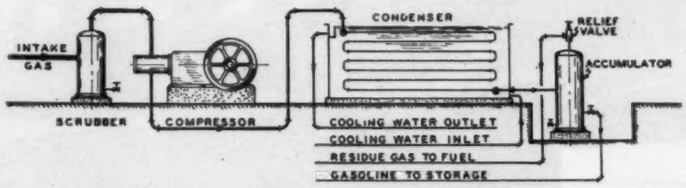
Will Trace the Development of Natural Gasoline Plant Design and Operation

In the beginning of the present century the natural gasoline industry was born. Since its inception this industry has become of major commercial importance. It now produces about 7 per cent of all motor fuel used.

The term "natural gasoline" applies in particular to that branch of the oil industry engaged in producing gasoline from natural gas. But for the purpose of discussing the different methods of manufacture the term may be enlarged to include gasolines manufactured from refinery still vapors, crude oil storage tank vapors, etc., as the gasoline content of these vapors are recovered by practically the same methods used in recovering gasoline from natural gas. While this industry is now over a quarter of a century old, it presented small prospects of becoming as large as it is today until the years of 1912-13. Then due to the rapid and enormous expansion of the automotive industry, and the subsequent need for volatile fuels, the gasoline industry was firmly established. The demand for gasoline rapidly increased which naturally stimulated research and investigation with the idea of discovering new and more efficient methods of gasoline extraction. While there have been few radical changes made in the original methods of gasoline extraction, there has been a steady improvement of these methods as will be seen in subsequent drawings and discussions on this page in future issues of The Oil and Gas Journal.

The accompanying flow diagram illustrates one of the earliest methods of extracting gasoline from natural gas and is the first of a series of diagrams attempting to show the various stages through which the gasoline industry has evolved in reaching its present stage of development.

The diagram represents the simple compression type gasoline plant where natural gas at a relatively low pressure is compressed to a pressure ranging from 2 to 20 atmospheres and discharged through pipe cooling coils where the gas is cooled to somewhere near its original temperature. In this process, advantage is taken of the physical principal that an increase in pressure is followed by a rise in the dewpoint of the gaseous mixture, thereby causing a portion of the heavier gasoline hydrocarbons to separate from the mixture by condensation.



While this condensate contains a greater proportion of the heavier hydrocarbons than the original mixture, it also contains a considerable portion of the lighter hydrocarbons that are not suitable for inclusion in a marketable gasoline product. For this reason it might be said in general that a stable gasoline, or a gasoline that will meet present-day market requirements, cannot be produced by this process alone when a maximum recovery of the gasoline content of the natural gas is desired.

It was the general practice when this type of plant was in use to recover the maximum quantity of gasoline regardless of its stability. The gasoline was then weathered or blended with naphtha to meet certain specifications demanded by the purchasers. Sometimes it required both weathering and blending to meet these specifications, entailing losses varying from 10 per cent to as much as 50 or 60 per cent. However, there are few plants of the simple compression type that produce a very stable grade of gasoline that requires neither blending nor weathering. But this is due to the unusual characteristics of the gas being treated and not to any mechanical features of the plant.

The operation of these early plants was quite simple in spite of the fact that they were almost entirely manually controlled. The only semblance of an automatic control was the relief valve that usually crowned the accumulator tank. The relief valve served to hold a fairly constant pressure on the condensing system. No liquid level controllers were necessary as it was quite customary to measure the product in the accumulator tank and then transfer it to the storage tanks where daily gauges were taken. The gauging and transferring of the product of these old plants presented the most difficult problem of their operation, in that the operator could never satisfactorily explain the difference between the gauges taken on the accumulator tank and those taken on the storage tanks.

Other flow diagrams will be presented from time to time and it will be seen that, for gases having certain characteristics, the compression type of plant has developed into one of the most efficient methods of gasoline extraction.

For Plant Operators

Natural gasoline prices have advanced 500 per cent in the past four months. The prospects now of maintaining the market at a profitable level are better than at any time within the past three years. During 1931, 1932 and 1933 to date, there has been little construction work done other than to keep the equipment reasonably safe.

There are more than 1,000 plants scattered over the country in all stages of physical condition and efficiency. Each operator knows how much in arrears his equipment and methods are with respect to the most modern and he is probably planning some type of improvement.

With this thought in mind, The Oil and Gas Journal will publish a series of flow charts and a discussion of each, depicting the progress of plant operating methods from the beginning. The accompanying chart shows the equipment and hookup of the first type of plant used by the industry. In subsequent issues each important change of design throughout the years will be shown in a chart. As the series progresses, it is hoped that operators will find suggestions that will be useful.

The series is intended to cover general principles of design and operation. It was prepared by Petroleum Engineering, Inc., affiliated with Arthur G. McKee Co.

Two More Flowing Plants for Oklahoma City Field

OKLAHOMA CITY, Okla., Oct. 24.—As the natural well pressure declines in the local field natural gasoline plant operators are being called upon for additional supplies of residue gas to permit artificial flowing. Work is now in progress for the early completion of two more flowing plants. Others will be needed as the pressure declines. In anticipation of this many small units have been projected.

The Anderson-Prichard Oil Corp. will build a three-unit flowing plant in the north end of the field. The company has let the contract for the construction work to J. F. Prichard & Co. It will include three Clark compressors.

The other plant is that of the Continental Oil Co. This will include one Clark compressor and the construction work has been placed with Matteson & Wallack.

Intermediate Distillation Points Favor East Texas

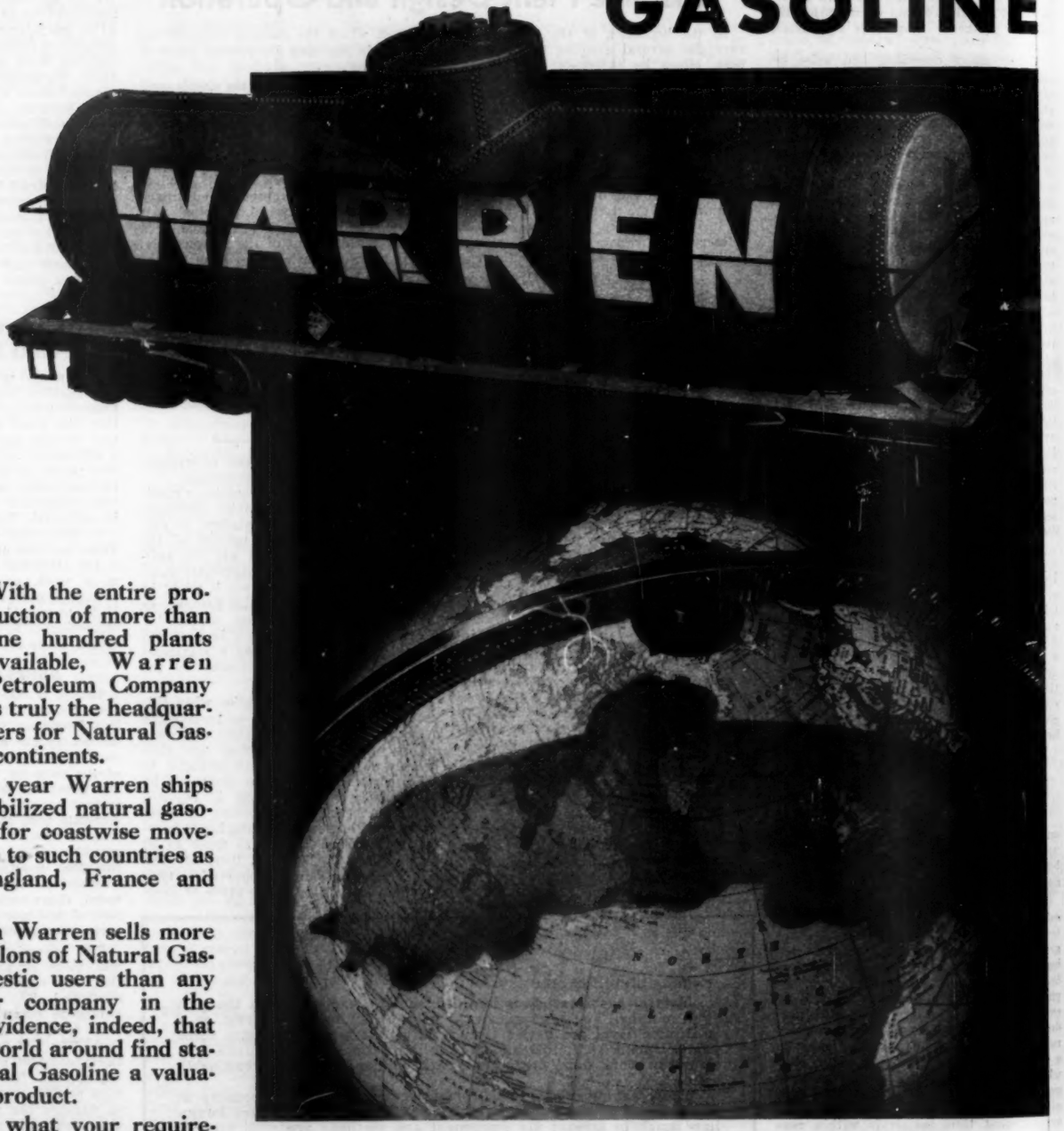
Export and coastwise purchases of natural gasoline, particularly the low vapor pressure grades, have been carrying more than the usual grade designation to insure certain qualities. Because there is a difference in the intermediate distillation points in the gasolines made in the various fields, some buyers and sellers have contended that recognition should be given this fact in the specifications.

In this rather technical difference East Texas gasoline appears to be favored and it has attracted price advantages in face of a weak general market. This has prompted operators in the East Texas Field to consider additional plants but other factors have entered the picture in recent weeks to discourage this.

OBERFELL ADVISER

George G. Oberfell, president of Phillfuels Co. and vice president of the Phillips Petroleum Co., has been appointed adviser to the administration board under Secretary Ickes in the application of the code for the liquefied gas industry. Details of the code were made known several weeks ago and were designed to correlate with the provisions of the general oil code.

Headquarters FOR NATURAL GASOLINE



With the entire production of more than one hundred plants available, Warren Petroleum Company is truly the headquarters for Natural Gasoline for two continents.

During the year Warren ships cargoes of stabilized natural gasoline not only for coastwise movement, but also to such countries as Germany, England, France and Spain.

Each month Warren sells more millions of gallons of Natural Gasoline to domestic users than any other similar company in the world . . . Evidence, indeed, that refiners the world around find stabilized Natural Gasoline a valuable blending product.

No matter what your requirements—Warren can quickly supply them.

* * * *

Stabilized Natural Gasoline, when properly blended, gives your gasoline increased volatility, increased octane rating, and lower initial. The three most important specifications to the automobile owner.

WARREN

FOR *TWO* CONTINENTS

La companie de petrole Warren a acces a la production totale d'une centaine d'usines et consequemment elle est le centre de deux continents pour l'essence naturel.

Pendant toute l'annee les bateaux Warren transportent de l'essence natural stabilisee non seulement le long de la cote, mais aussi en France, en Allemagne, en Angleterre, et en Espagne.

Chaque mois la companie Warren vends plus d'essence naturel pour consommation indigene que toute autre companie comparable, ce qui prouve, que les raffineries en toute les parties du monde trouve l'essence naturel stabilisee de grand avantage pour ajouter aux produits du raffinage.

Quel que soit vos besoins la companie Warren peut vous livrer sans delai.

L'essence naturel stabilisee proprement melangee donne a l'essence une volatilite plus grande, plus d' octane et une temperature reduite a laquelle l'evaporisation commence. Ces trois specifications sont de grande importance pour les automobilistes.

Con una produccion de mas de cien instalaciones a su disposicion, la compania de petroleo de Warren es verdaderamente la oficina principal de la gasolina natural de dos continentes.

Durante el ano la compania de Warren expide cargamentos de gasolina natural neutralizada, no solamente a lo largo de la costa, sino tambien a tales paises como Alemania, Inglaterra, Francia, y Espano.

Todos los meses la compania de Warren vende millones de galones de gasolina natural mas al mercado natino que cualquier otra compania semejante del mundo . . . la mejor prueba que los refinadores de todo el mundo hallan que la gasolina natural neutralizada es un producto estimable que se combina bien.

No importa lo que son los requisitos de Ud—la compania de Warren puede proveerlos con presteza.

La gasolina natural neutralizada, cuando propriamente combinada, resulta en una gasolina de mayor volatilidad, mayor octane e inicial mas reducida. Estas son los especificaciones mas importantes al dueno de un automovil.

Der Warren Petroleum Company steht die Gesammtproduktion von uber hundert Fabriken zur Verfugung und so ist diese Gesellschaft wirklich die Zentrale fur naturliches Gasolin fur zwei Kontinente.

Das Jahr durch verfrachten die Warren Schiffe Ladungen stabilisierten naturlichen Gasolins nicht nur im Kustenverkehr, sondern auch nach uberseeischen Landern wie Deutschland, England, Frankreich, und Spanien.

Jedena Monat verkauft Warren Mehr naturliches Gasolin an inlandische Konsumenten als irgend eine andere ahnliche Gesellschaft der Welt. Dies ist ein klarer Beweis, dass die Raffinerieen der ganzen Welt stabilisiertes naturliches Gasolin wertvoll zu Mischungen finden.

Was auch Ihr Bedarf sei, Warren kann ihn rasch liefern.

Stabilisiertes naturliches Gasolin, richtig gemischt, gibt Ibrem Benzin vermehrte Volatilitat, hoheren Oktangehalt und niedrigere Anfangssiedetemperatur. Diese drei Eigenschaften sind die wichtigsten fur den Automilbesitzer.

PETROLEUM COMPANY

Exchange Tower TULSA, OKLAHOMA

"JUST NATURAL GASOLINE"

Changing Conditions in Semi-Flush Major Pools Create Greater Demand for Stripper Oil

By L. G. E. BIGNELL
Petroleum Engineering Editor

Many natural conditions have changed in the oil fields of Oklahoma within the past six months that are bringing about a situation not thought possible by a large majority of operators a short time ago. Potentials taken in fields under proration have been misleading and it has been customary to assume that because wells would flow at a high rate for a short time when tested individually or in groups that the field as a whole could duplicate this performance. This assumption has led to many abuses in the petroleum industry and the disregard for natural and physical laws that are now making themselves manifest.

In spite of warnings and past experiences the industry as a whole insisted upon producing oil in excess of current demand. Numerous unnecessary wells were drilled, oil was sold at much below production cost, and the marketing department of the industry faced cut-throat competition in all parts of the country.

The Oklahoma City and Seminole Fields in Oklahoma have been regarded as being capable of producing their full allowable without difficulty for a long time to come. They will still continue to produce much oil but along with it they will have to handle large volumes of water and this will be costly. It was recently stated at a meeting of the Corporation Commission that 80 per cent of the leases in the Greater Seminole oil district are producing water in excess of 10 per cent, and the majority of the wells produce a barrel of water for each barrel of oil. Others placed the ratio of water to oil as high as 4 to 1 on many leases.

It is now proposed to test all water wells in the Greater Seminole district for a 30-day period beginning November 1. This will be done to determine their capacity to produce; 75 per cent of this amount will be taken as potential and allowable, while the potential will be scaled down at the rate of 3 per cent per month thereafter.

Some operators maintain that if 75 per cent of the wells in this district were permitted open flow production it would not injure many of the wells. It would insure greater recovery of oil from the sand and lengthen the life of the field.

In the Oklahoma City Field it is reported that there is an underage in production of 3,233,598 bbls. as of October 1 as against an underproduction of 1,424,074 bbls. on September 1. This amount includes both current and deferred underproduction due to changing the allowable order of September 8 when the state's output was cut from 601,000 to 540,000 bbls. per day.

Reconditioning Wells

These facts are of significance when it is also remembered that many wells in both Oklahoma City and Seminole district have been reconditioned recently and this character of work is now going on steadily. Water has definitely entered the Wilcox sand zone in Oklahoma City. This water is coming updip in the formation and also entering the Wilcox through wells that have penetrated through that formation and into the lower Simpson underneath.

So long as the Wilcox formation pressure was higher than that in the lower Simpson zone water did not move upward to the Wilcox sand through the combination wells. It is now reported that the bottom hole pressure in the Wilcox sand is between 900 and 1,000 pounds per square inch and as the lower Simpson pressure is somewhat higher the water is moving up into the higher and softer Wilcox sand zone quite freely.

While the percentage of water to oil produced from the Wilcox sand does not exceed 10 per cent in most wells the fact that water is definitely known to be in this formation is giving operators much concern and they have many wells shut down trying to recondition them to reduce water, also to lower gas-oil ratios.

An order issued by the Corporation Commission, effective August 15 last, regulating and classifying gas-oil ratio wells has proven a very beneficial thing for the field and it is only to be regretted that it has been applied to the Wilcox sand zone so late in its life.

This order, known as Cause No. CD-4, Order No. 6,433, states that producing more than 5,000 feet of gas per barrel of oil from the Wilcox zone is unreasonable. It has therefore divided wells into Class 1, with a gas-oil ratio of not more than 5,000 feet per barrel of liquid; Class 2, all wells with a gas-oil ratio in excess of 5,000 feet and not more than 20,000 feet per barrel of liquid and Class 3, wells producing in excess of 20,000 feet of gas per barrel of liquid.

The order provides, "After such determination has been made and all wells so classified, subject to such corrections as may be necessary when the gas-oil ratio of wells is redetermined in the manner herein provided, and commencing at 7 a.m. the first day of October, 1933, potential period, all wells having a gas-oil ratio of 5,000 feet per barrel of liquid, or less, will be allowed to produce each month their full allowable production.

"Provided, that all of said wells shall be tubed within 60 days of the effective date of this order with tubing not greater than 3 inches outside diameter and to a depth of not less than 5,000 feet measured from the derrick floor unless the operator demonstrates to the satisfaction of the umpire that such tubing actually increases the gas-oil ratio of such well.

"All wells having gas-oil ratio in excess of 5,000 feet per barrel of liquid, but not in excess of 20,000 feet per barrel of liquid, and not transferring their allowable oil production to other wells on the same lease, will not be allowed to produce each month their full allowable production, but shall be limited and restricted and permitted to produce each month the proportion of their current allowable production which the percentage of the gas-oil ratio of 5,000 feet per barrel of liquid is of the gas-oil ratio of each such wells."

This may be illustrated as follows. A well produced liquid with gas in the ratio of 8,000 feet per barrel. The allowable is 5,000 feet so the fraction would be 5,000 over 8,000 or five-eighths allowable production. This means that the well with this 8,000 feet gas-oil ratio can produce five-eighths of its oil and the balance, or three-eighths, will be treated as deferred production not to be produced during the current month.

Wells over 20,000 gas-oil ratio were ordered shut in entirely, except where it could be shown to the satisfaction of the umpire that all of this gas was being used for some useful purpose. If sold to some utility company for fuel or used in producing other wells from the Wilcox sand by gas-lift, the high gas-oil ratio well could be produced. However, not more than 3,000 feet of gas per barrel of liquid could be used in the gas-lift operation.

This order now in effect is to be considered at a hearing of the commission on Tuesday, October 24. It has been learned that some operators of one well leases that have gas-oil ratio in excess of 20,000 and are therefore shut in completely and have no place to dispose of their gas in a "useful" manner have considered selling their oil in place to adjacent companies who had wells that were permitted to produce.

This is an innovation in many ways. The fixing of the gas-oil ratio of wells and the possible sale of oil in place to offset neighbors indicates a very much changed attitude on the part of the producers large and small.

New Order for Oklahoma City Field

To control further movement of salt water in the Wilcox sand in the Oklahoma City Field the Corporation Commission of the State of Oklahoma has modified, supplemented and amended Section 9 of Order No. 6,433 covering drilling, casing, equipping, completing, operating and other requirements pertaining to Oklahoma City Wilcox sand wells.

It is required that each operator file daily report showing the per cent of water produced by each well. If no water is produced, the report shall so state. This provision covers producing wells and is intended to give data from which a water record for the field can be made.

The order further provides that all persons now or hereafter engaged in drilling wells in the Wilcox zone on the Oklahoma City Field are prohibited from drilling below a depth of 5,330 feet below sea level, except upon written permission from the proration umpire. The operator must notify the proration umpire's office when he desires to drill below the 5,330-foot below sea level depth because this is now established as the common water table for this formation. It was originally at 5,400 feet below sea level. The water table has therefore risen about 70 feet but in some places water has fingered into the Wilcox formation to much higher levels.

If a well drilled below 5,330 feet below sea level depth shall make more than 3 per cent salt water it is required that it be plugged back to a depth of not less than 5,330 feet within 60 days from the time such notice is given by the umpire requiring this work to be done. There are penalties provided for failure to follow this order.

Casing Program

Notice of intention to complete the well must be filed with the Proration Umpire at least 24 hours in advance of commencing work and a representative of his office will be present when the well is drilled in and tested. The test period will be prescribed by the representative of the Umpire's office at the well and the initial production computed from the hour and minute the flow of oil and water from said well first reaches lease tankage in which the same is to be measured.

The oil produced by any such well during such time shall be gauged in tankage which has been strapped in accordance with the usual and customary practices prevailing in the Oklahoma City Field, and the amount of oil produced shall be calculated on the basis of 97 per cent tank tables. The usual and customary tests and deductions shall be made for water and B. S. content, all oil produced shall be charged to said well and made up as overproduction.

If the well has been drilled in with fluid other than oil, the potential gauge may be taken during the last four hours of the test period of intention to follow this method is filed with the Umpire in advance. Wells completed with oil may determine their potential during any continuous four-hour period after the first hour. All wells must be completed between 6 a. m. and 6 p. m. and written reports filed with the Umpire within 48 hours after the initial test. The oil produced during the test period shall be charged to the well as overproduction and the well shut in for 65 days, less the time drilling was suspended for the purpose of allowing cement in the casing to set.

The order provided that the operator may at his option take all or any part of such total shut-in time after completion of the derrick and before rigging-up operations are commenced. He may elect to start drilling before this period has expired if he so notifies the Umpire. He will be allowed credit for shut time as he may have been shut down in this event. No credit will be allowed on shut-down time after drilling has commenced on the well until the "oil string" of casing has been cemented and allowed to stand the required length of time.

Stripper Wells

This general condition existing in the larger fields whereby they are not able to deliver their full quota of oil at this time has thrown an added burden upon the so-called "stripper" wells in the state. They are permitted to produce a total of 180,000 bbls. per day and it is understood that they have not been able to deliver this amount. Many of them have been reconditioned with tools and by the use of acid and have responded nicely. However, there is still much to be done to these thousands of wells scattered over the eastern half of Oklahoma.

This reconditioning applies equally to large wells in the semiflush fields and to the old settled producers in the other fields. The demand for oil is quite steady and it is being purchased in every district and field where offered. Pipe line connections are being made to hundreds of wells formerly not considered desirable. With the withdrawals from storage limited there is an ever increasing number of problems facing the producers. Even at the present price it is doubtful if there is real profit in producing the oil if reconditioning costs are considered.

It is going to be necessary that all of these old wells be worked over sooner or later. When any operator in a field reconditions his well he is starting a cycle of similar operations that will continue through the field or pool until every well in it has been put in similar condition.

This is one of the fundamental rules of production. No operator will permit his neighbor to continue to produce more oil from a common reservoir than he is securing. As soon as he learns that by some means a well has been made to produce additional oil he is anxious to try it in his well and usually will find some means of doing so, or working his well over in some other way that he considers will give as good or better results.

Slow Steady Advance Being Expected in Chicago District Refinery Market

By SPECIAL CORRESPONDENT

CHICAGO, Oct. 23.—Belief in the efficacy of the oil administraiton's plans for generally higher prices began to take on added emphasis in the Chicago oil market community as the week closed and extended itself as the new week opened. With sellers apparently much surer of their position, tank car gasoline prices firmed up noticeably and the tone throughout the refinery market was stronger and healthier.

The refinery market now appears to be addressing itself to the question of how and when the present substantial discrepancy between current ruling prices and the higher minimum prices ordered effective December 1 will be wiped out. Most opinion here would seem to be that a slow, steady advance may be expected over the immediate and near future. It is certain refiners and sellers generally are much more encouraged over prospects and now feel they have something definite to which to look forward. There is a growing feeling that the recent inclusion of refining operations within the scope of the administration's authority constitute the reduction of the last principal remaining fortress holding out against the stabilizing program. The trade here appears to feel that it will have a vital and significant effect on affairs of the industry.

Tank car gasoline prices are fractionally better than a week ago. It appears the distress motor fuel which has plagued the market for many weeks is finally out of the way and that market activities can be conducted in more nearly normal and regular channels. It is generally declared the particular situation which led to the embarrassment of the tank car gasoline market in the past six weeks—the utilization of private storage at important terminals on minimum charge arrangements with railroads until opportunity presented itself to unload the material—is definitely and permanently a thing of the past.

Inquiry in various refining centers which have been a source of cheap gasoline in the last month or two brings out the statement that they are clear of cheap gasoline offerings. Many refiners are now holding for prices considerably ahead of the market. With this firmer psychological condition developing on the part of refiners, jobbers have begun to pay a little more attention to the market. Not that they are throwing heavy orders into the spot market, but they are willing to buy a little material here and there, whereas recently they have developed almost entirely on their contracts to take care of their needs. Contract shipments into this general central marketing territory have been large for weeks and are quite large now. Jobbers on the whole seem more friendly to the market and more nearly convinced that higher prices are likely.

Natural gasoline's strength has been reflected in the refinery tank car market here by increased interest in the regular high gravity items, although these still form a limited portion of the business. Low temperatures are bringing a certain amount of expanded inquiry for these items, and they are strong marketwise. Of course the high octane materials are holding their relative positions.

Kerosene

Burning oils are ready to move up in sympathy with motor fuels, in the opinion of some observers. With low octane motor gasoline now once more well above the 4-cent level, it is extending its margin over kerosene which for a long time placed motor fuel in an unfavorable comparison. The demand for kerosene has been quite good and around 3½ cents it has been getting a good call from the rural trade.

Heating Oils

Heating oils have been marking time but they are beginning to be called for a little more briskly. Most consumers still have good stocks and dealers are keeping their own storage well filled. Refinery stocks, however, are regarded as moderate. Prices are about unchanged, but refiners and car lot marketers are in some cases talking higher prices, despite the fact much retail business is now being done at the top of a price pegged by contracts. Cold weather fuels and gas oils are quiet but firm.

Industrial Fuels

Industrial gas and fuel oil demand is not all that might be desired here, due to considerable irregularity in the general industrial situation. Prices are holding in most cases, but industrial consumers are wary buyers.

Lubricants, Wax

Lubricants are maintaining a quite firm price situation, although the demand is slow at the present. There is little new buying, although a general impression appears to be that no reduction can be expected in the refinery market and that if anything prices might work higher. Wax continues extremely strong.

Naphthas

Solvents and naphthas show little change. In some quarters there is a disposition to hold for a little more money for them, and the price structure appears a small fraction stronger, but business is slow.

Crude Oil Prices

(Continued from Page 39)

Lance Creek (Dec. 16, 1932)	.92
Poison Spider (Mar. 5, 1931)	.70
Hudson (June 2, 1931)	.65
Lander (Mar. 5, 1931)	.40
Rex Lake (Feb. 22, 1930)	1.10
Osage (Jan. 13, 1932)	.53
Lost Soldier (Sept. 30, 1933)	.38
Hamilton Dome (Dec. 16, 1932)	.36
Torchlight (Sept. 29, 1933)	1.18
Greybull (Sept. 29, 1933)	1.18
Pondera	1.15
Sunburst (Sept. 29, 1933)	1.35
Cat Creek, Montana	1.07
Hogback (Sept. 29, 1933)	1.11
Lea County, N. Mex. (Sept. 29, 1933)	.70
Maljamar (Sept. 29, 1933)	.70
Artesia-Jackson (Sept. 29, 1933)	.70

Note—Salt Creek, Torchlight, Elk Basin, Grass Creek, Frannie, Greybull, Hogback and Iles by Stanolind Oil & Gas Co. Elk Basin, Grass Creek light, Big Muddy, Rock Creek and Sunburst by Ohio Oil Co. Lost Soldier posted by Producers & Refiners Corp. Artesia, Jackson and Maljamar posted by Continental Oil Co. Lea County, effective September 29, by Humble Oil & Refining Co. and other buyers; Fort Collins, Wellington, Orchard, Florence, Big Muddy, Cat Creek, Rattlesnake and Table Mesa by Continental Oil Co. Osage posted by Arro.

*Continental Oil Co.

North Louisiana and Arkansas

Smackover, Ark (all grades)	$.70
Urania, La. (Oct. 3, 1933)	.75
Nevada, Ark. (Sept. 29, 1933)	.60
East El Dorado (Sept. 29, 1933)	.70
Other fields	(See gravity table)

Note—Smackover: Effective September 29, 1933, Texas Co., Magnolia Petroleum Co., Standard of Louisiana, Louisiana Oil Refining Corp., Gulf Refining Co. and Phillips Petroleum Co. East El Dorado posted by Magnolia Petroleum Co. and Gulf Refining Co., Nevada by Standard Oil Co. of Louisiana. Urania posted by H. L. Hunt, Inc., and Louisiana Oil Refining Co.

Eastern States

TIDE WATER PIPE CO.
(Effective October 4, 1933)

Bradford, Pa.	$2.45
Allegany, N. Y.	2.45

SOUTH PENN OIL CO.
(Effective October 4, 1933)

Pennsylvania Grade Oil in National Transit Lines (Bradford Field)	$2.45
Pennsylvania Grade Oil in Southwest Pennsylvania Lines	2.12
Penna Grade Oil in Eureka Pipe Line Lines	2.07
Penna Grade Oil in Buckeye Pipe Line Lines	1.93
Corning Grade Oil in Buckeye Pipe Line Co.'s lines (Oct. 2, 1933)	1.33

PENNZOIL CO.
(Effective October 4, 1933)

Pennsylvania Grade Oil in National Transit Lines:	
Group A	$2.37
Includes Cochran, Franklin, Hamilton and Doolittle districts.	
Group B	2.36
Includes Titusville district.	
Group C	2.35
Includes Turkey and Tidioute districts.	
Group D	2.34
Includes Bear Creek and Porkey districts.	
Group E	2.32
Includes Edeneau, Bull Creek, Rough Run, Carbon, Dipner, Bredin, McJunkin, Jameson, Kennerdell, Emlenton, Tiona, Lacy and Kinsua districts.	
Price depends on length of pipe line haul to plant at Oil City.	

PURE OIL CO.
(Effective October 4, 1933)

Cabin Creek, W. Va.	$2.17
Bradford Hollow, W. Va.	2.17
Kelly Creek, W. Va.	2.17

Middle Western States

OHIO OIL CO.
(Effective September 29, 1933)

Lima	$1.36
Illinois	1.33
Princeton, Ind.	1.33
Plymouth	Shut In
Western Kentucky	1.18
Midland, Mich. (Sept. 30, 1933)	1.02
Oceana, Mich. (Oct. 5, 1933)	.90
Somerset, Ky. (Sept. 30, 1933)	1.23
Hart County, Ky. (Oct. 1, 1933)	1.18

*Posted by Pure Oil Co. Producers Pipe Line Co. pays 5 cents per barrel over Pure Oil Co.'s posted price. Somerset, Ky., crude purchased by Ashland Refining Co., Ashland, Ky., and posted price includes premium. Hart County, Kentucky, crude purchased by Stoll Refining Co. Oceana posted by Old Dutch Refining Co. and Naph-Sol Refining Co.

Canada

Ontario (September 9, 1933):	
Petrolia*	$2.10
Oil Springs*	2.17
Turner Valley (September 11, 1933):†	
Clear naphtha	$3.50
Discolored naphtha	3.34
Crude oil, 50 gravity	2.93
Crude oil, 45 to 49.9	2.36
Crude oil, 40 to 44.9	1.61

*Imperial Oil, Ltd. †Imperial Oil, Ltd., and Regal Oil & Refining Co.

Mexico

Panuco*	$.466

*F.o.b. ship, based on August transactions and exclusive of production and export taxes and har dues.

California Crude Oil Prices

STANDARD OIL CO. OF CALIFORNIA
(Effective September 6, 1933)

For current purchases of crude oil at the well (unless otherwise specified). (All gravities above those quoted take highest price offered in that field.)

Gravity—	Long Beach	Seal Beach, Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda, Brea Canyon	Athens-Rosecrans	Torrance	Richfield	Whittier La Habra	Montebello	Santa Fe Springs	La Habra-Coyote	Midway-Sunset, Elk Hills, Buena Vista Hills	Lost Hills	Coalinga	Coyote
10-14.9	$.65	$.65	$.65	$.65	$.65	$.65	...	$.65	$.65	$.65	$.65	...	$.65	$ 57	$.57	$.57	$.65
15-15.9	.65	.65	.69	.69	.66	.69	...	.66	.66	.65	.65	...	.65	...	...	...	.65
16-16.9	.66	.66	.72	.73	.69	.73	...	.69	.67	.68	.65	...	.65	...	...	...	.66
17-17.9	.69	.65	.75	.76	.73	.76	...	.72	.70	.71	.65	...	.68	...	...	...	.68
18-18.9	.72	.65	.78	.80	.76	.79	...	.75	.74	.74	.65	...	.71	.61	.61	.59	.71
19-19.9	.75	.65	.81	.83	.80	.82	...	.78	.78	.78	.65	...	.74	.64	.65	.62	.74
20-20.9	.78	.68	.83	.87	.83	.85	...	.81	.82	.81	.66	...	.78	.67	.69	.65	.78
21-21.9	.81	.73	.86	.90	.87	.88	...	.83	.85	.84	.69	$.72	.81	.70	.73	.68	.81
22-22.9	.84	.76	.89	.94	.90	.92	...	.85	.89	.87	.72	.76	.84	.73	.76	.72	.84
23-23.9	.88	.81	.92	.97	.94	.95	$.83	.89	.93	.90	.76	.79	.87	.77	.79	.75	.87
24-24.9	.91	.85	.95	1.01	.97	.98	.86	.92	.97	.93	.80	.83	.90	.81	.82	.78	.90
25-25.9	.94	.89	.98	...	1.00	1.01	.90	.95	1.00	...	.85	.87	.93	.85	.85	.81	.93
26-26.9	.97	.93	1.01	...	1.04	1.04	.94	.98	1.04	...	.89	.90	.96	.89	.88	...	.96
27-27.9	1.00	.98	1.04	...	...	1.07	.97	...	1.08	...	...	.94	.99	.93	.91	...	.99
28-28.9	1.03	1.03	1.07	...	...	1.10	1.01	...	1.11	...	...	.98	1.02	.97	.94	...	1.02
29-29.9	1.06	1.05	1.09	...	...	...	1.04	...	1.15	...	...	1.01	1.05	1.01	.97	...	1.05
30-30.9	1.09	1.10	1.12	...	...	...	1.08	...	...	...	...	1.05	1.09	1.05	1.00	...	1.09
31-31.9	...	...	...	...	...	...	1 12	...	...	...	...	1.08	1.12	1.09	...	...	1.12
32-32.9	...	...	...	...	...	...	1.15	...	...	...	...	1.12	1.15	1.13	...	...	1.15
33-33.9	...	...	...	...	...	...	...	...	...	...	...	1.16	1.18	1.17	...	...	1.18
34-34.9	...	...	...	...	...	...	...	...	...	...	...	1.19	1.21	...	...	...	1.21
35-35.9	...	...	...	...	...	...	...	...	...	...	...	1.23	...	...	...	...	...
36-36.9	...	...	...	...	...	...	...	...	...	...	...	1.26	...	...	...	...	...
37-37.9	...	...	...	...	...	...	...	...	...	...	...	1.30	...	...	...	...	...
38-38.9	...	...	...	...	...	...	...	...	...	...	...	1.34	...	...	...	...	...

Additional Standard Oil Quotations

Elwood Terrace—F.o.b. ship, 33 degrees, $1.03; 34 degrees, $1.06; 35-35.9, $1.09; 36-36.9, $1.12; 37 degrees and over, $1.15.

Newhall—14 degrees and over, 57 cents.

McKittrick and Kern River—14 degrees and over, 57 cents.

Wheeler Ridge—14 to 17.9 degrees, 57 cents; 18-18.9, 58 cents; 19-19.9, 61 cents; 20-20.9, 64 cents; 21-21.9, 67 cents; 22-22.9, 70 cents 23-23.9, 73 cents; 24-24.9, 76 cents; 25 degrees and over, 79 cents.

Kettleman Hills—33-33.9 degrees, 92 cents; 34-34.9, 96 cents; 35-35.9, 99 cents; 36-36.9, $1.02; 37-37.9, $1.05; 38-38.9, $1.08; 39 degrees and over $1.11.

The Texas Co. posted in Shiel Canyon, South Mountain and Santa Paula as follows: 14 to 17.9, 57 cents; 3 cents added for each degree up to and including 26-26.9 degrees at 84 cents; then 4 cents added for each degree up to and including 30 degrees and over at $1. Company posts Standard Oil Co.'s Montebello prices in Montebello and North Whittier, and posts Standard Oil Co. prices in Signal Hill, Alamitos Heights, Huntington Beach, Torrance, Richfield and Santa Fe Springs, all effective September 6.

General Petroleum Co. posts Standard Oil Co. prices in Athens, Rosecrans and Signal Hill; Alamitos Heights up to 26-26.9; Santa Fe Springs up to 25-25.9; Richfield up to 25-25.9; Brea Canyon and Olinda up to 25-25.9, and Torrance up to 26-26.9.

Union Oil Co., effective September 6, posts same prices as Standard Oil Co. in all fields in which both purchase, excepting that in Athens-Rosecrans, Union Oil Co. posts 21-21.9, 72 cents, and 33-33.9, $1.18; 34-34.9, $1.21, and 35-35.9, $1.24.

Associated Oil Co., effective September 6, posted same prices for the same grades as Standard Oil Co. of California, excepting that in some fields its gravity scale stops as follows: Huntington Beach, 36 degrees and over; Seal Beach and Alamitos Heights, 32 degrees and over; Coyote Hills, 28 degrees and over; Richfield, 35 degrees and over; Torrance, 25 degrees and over; Inglewood, 34 degrees and over; Santa Fe Springs, 35 degrees and over, Midway-Sunset, Elk Hills, Buena Vista Hills, 30 degrees and over. Also Associated pays 52 cents for oil of 11 to 13.9 gravity in McKittrick, Kern Front, Kern River, Midway-Sunset, Elk Hills, Buena Vista Hills, and Coalinga.

Late Fields

MICHIGAN

MUSKEGON, Mich., Oct. 24.—Muskegon Oil Corp.'s No. 1 N. Lieffers, NW NE SW Section 22-9-14w, Ravenna Township, Muskegon County, was dry and abandoned at 2,110 feet after testing upper and lower Traverse. Lieffers is the seventh structure test drilled in the county by the Muskegon corporation in the past two years seeking a new oil or gas pool.

British Columbia Fuel Oil Tax Law Held to Be Valid

CHATHAM, Ontario, Oct. 23.—An important decision was given in London, England, October 12, when the judicial committee of the privy council upheld the validity of the British Columbia Fuel Oil Tax Act of 1930. In 1930 the provincial government authorized a tax of one-half cent a gallon on fuel oil. The tax was opposed by various interests, and the British Columbia government thereupon instituted a test case against the Kingcombe Navigation Co. for $3,900, under the 1930 act, which went into force June 1, 1932.

In British Columbia courts successive decisions held the act to be invalid. A final appeal accordingly was taken by the British Columbia government to the privy council, the court of last resort. The judicial committee of the privy council has now allowed the appeal, and declared the act to be valid.

An earlier fuel oil tax enacted in British Columbia was ruled ultra vires by the privy council on the ground that it imposed an indirect tax and therefore was not within the competence of the provincial government under the terms of confederation. The present tax is held to be direct taxation within the meaning of Section 92 of the British North American Act, and therefore within the powers of the province.

An annual revenue of $400,000 was involved in the litigation. In addition, the decision probably will mean the enforcement in Ontario of a fuel oil tax of one-half cent a gallon, enacted at the last session of the legislature, but held in abeyance pending the result of the British Columbia test case.

Rules Commission Cannot Force Making Up Excess

FORT WORTH, Tex., Oct. 23.—The Texas attorney general's department ruled today that the Railroad Commission lacks authority to force oil producers to make up overproduction in excess of allowable.

The commission sought the ruling after receipt of a telegram from Secretary of the Interior Ickes, oil administrator, threatening to bar part or all of the production from various states entering interstate commerce.

The attorney general's ruling will have the effect of forcing producers observing the allowables in the past to share part of the burden in making up the overage, rather than compelling the violators alone to shoulder the burden.

Texas has overproduced the Federal allowable by more than 1,000,000 bbls. since the first allocation was made on September 8.

CARBON BLACK PRICE RISE

NEW YORK, Oct. 23.—The advance of 1½ cents a pound in the spot export price of carbon black is taken in the trade as a precursor of a rise in the domestic market. At the price of 2.72 cents a pound, Texas points, the lowest level reached for the grades used in tires, there is no net profit. On 1934 business, contracted in the fall of this year, there is likely to be a higher price, one at least sufficient to enable producers and distributors to meet costs.

Improvement in prices would benefit Columbian Carbon Co., United Carbon Co., and also the Phillips Petroleum Co.

Secretary Ickes Suggests Relief Measure for Small Producers and Refiners

WASHINGTON, D. C., Oct. 24.—Secretary of the Interior Harold L. Ickes, as administrator of the petroleum code, today announced that the required daily production of crude oil had been found by the Department of the Interior to be 2,130,000 bbls. through the months of December, 1933, and January, 1934.

Allocations to the several states governing the production within the states for these months will not be certified by the administrator until November 20, 1933, to allow the petroleum administrative board to accumulate further statistics concerning changes in trade channels for petroleum and its products.

The prohibition against withdrawals of stored oil is continued in effect. The administrator, however, concurrently issued an order designed to relieve independent refiners and producers from hardships imposed by the existing prohibition.

Under this supplemental order, producers holding relatively small quantities of oil in storage may sell such oil to buyers who will agree to treat it as stored oil upon receiving the consent of the regional production committee of the Planning and Co-ordinating Committee of the industry, it being provided that such oil as is purchased under an agreement of this character shall be the first oil permitted to be withdrawn from storage when an increase in the seasonal demand for petroleum and its products makes possible some withdrawals from storage that will not unduly prejudice the interests of producers. The order is effective until an orderly plan governing withdrawals from storage is approved by the administrator.

The administrator also provided for the relief of refiners who, because of low gasoline inventories, are unable to meet their individual requirements from current production, by permitting such refiners to run to stills oil stored or purchased as above, upon receiving the consent of the Planning and Co-ordinating Committee, in such amounts and over such a period of time as the committee may deem necessary.

All such action is subject to the consent of the Planning and Co-ordinating Committee under the oil code.

Hearings on Price Fixing Will Be Begun October 30

WASHINGTON, D. C., Oct. 24.—The oil administration issued orders this afternoon under which objections to the price-fixing schedules in the order of October 16 will be heard. Hearings will begin October 30.—C. E. K.

TEXAS ANTITRUST LAW

AUSTIN, Tex., Oct. 23.—Governor Ferguson has approved, making immediately effective, the bill modifying Texas antitrust laws to conform to the National Recovery Act, by making compliance with approved code a defense in any state antitrust prosecution, the act excepting any cases accruing before code formulation.

Mid-Continent Refinery Market Is Showing Gain

(Continued from Page 36)

stocks worked into a stronger position somewhat in sympathy with the general improvement. It is difficult to establish a narrow price range for cylinder stocks because of the wide variety of quality. Most of the material is sold on the basis of type samples, and the best color, 600 fire steam refined stock, brought up to 9 cents and the dark residual stocks could be had at 5 cents.

Wax stocks have been reduced to a low point in the Mid-Continent and current production is being shipped as fast as finished. There was no difficulty in getting 3¾ cents for the 124 to 126 melting point grade.

Administrator Ickes Issues Production Figure Orders

(Continued from Page 26)

United States decreased 1,154,000, making a net addition of 3,720,000 bbls. During the week ended October 14, the same reporting companies recorded a decrease in domestic crude oil stocks of 782,000 bbls. and in foreign crude stocks of 258,000 bbls., or a total decrease of 1,040,000 bbls., a daily average of approximately 150,000 bbls.

Current oil reports indicate that crude oil production during the week ended October 14 amounted to 2,420,000 bbls. daily which, with the addition of the daily average of 112,000 bbls. of domestic crude oil drawn from storage, indicates a daily average utilization of domestic crude oil of 2,532,000 bbls. Petroleum refineries, during the week ended October 14, refined a daily average of 2,445,000 bbls., and gasoline stocks during the week were increased by 920,000 bbls., according to current oil industry reports. It was explained that the 920,000 bbls. of gasoline placed in storage is the equivalent in crude oil of about 300,000 bbls. daily, which represents approximately the excess throughput of crude oil at domestic refineries during the past week.

Price Schedules for California Crude

Through an oversight on the part of the Planning and Co-ordinating Committee, it failed to recommend minimum price schedules for California crude oil in six of the California fields. Through an order Secretary Ickes amended the price fixing order, effective as of December 1, 1933, to include the omitted territory.

The additional schedules, recommended by the Planning and Co-ordinating Committee, follow:

	Santa Paula Shiells Canyon South Mountain	Orcutt	Fruitvale Mt. Poso Round Mountain East Coyote	Kern Front	Ventura	Rincon
11-11.9	....	....	....	$0.52	....	....
12-12.9	....	....	....	.52	....	....
13-13.9	....	....	....	.52	....	....
14-14.9	$0.57	....	$0.65	.57	....	....
15-15.9	.57	....	.65	.57	....	....
16-16.9	.57	$0.57	.69	.57	....	....
17-17.9	.59	.59	.73	.57	....	....
18-18.9	.61	.62	.77	.57	....	....
19-19.9	.64	.65	.81	.57	....	....
20-20.9	.67	.69	.85	.57	....	....
21-21.9	.71	.72	.89	.57	....	....
22-22.9	.75	.76	.94	.57	$0.83	$0.82
23-23.9	.79	.81	.99	.57	.87	.87
24-24.9	.83	.86	1.04	....	.91	.90
25-25.9	.88	.91	....	....	.95	.93
26-26.9	.92	.96	....	....	.99	.96
27-27.9	.98	....	....	....	1.03	.99
28-28.9	1.03	....	....	....	1.07	1.02
29-29.9	1.08	....	....	....	1.11	1.05
30-30.9	1.13	....	....	....	1.15	1.08

Under heading of Montebello add North Whittier. Under heading of Lost Hills add Belridge. Under heading of Athens, Rosecrans and Domingues add Potrero. Add to schedules for Midway-Sunset, Coalinga and McKittrick, 11-11.9 degrees, 53 cents; 12-12.9, 52 cents; 13-13.9, 52 cents.

New York Oil Producers Hear Fayette Dow on Code

By ROBERT C. CONINE

OLEAN, N. Y., Oct. 21.—Fayette B. Dow, general counsel for the Pennsylvania Grade Crude Oil Association, questioned the possibility of a successful attack on the constitutionality of the NRA and presented some interesting points before 200 members of the New York State Producers Association at their annual meeting here.

Now, Mr. Dow said, that competition has run wild, and has become destructive, it seems to follow naturally that Congress, which freed competition, may move to restrict competition no less effectually. While we are now using the Federal Government as an agent for exerting a very complete control over American business, this government is clearly assuming new and broader functions, and when more attention may be given to property rights during future bettered business conditions, not all of the steps that have been taken in the direction of government control will be retraced.

A continuation of conditions such as those that faced the industry in the first six months of this year would have meant economic disaster. The oil industry's code of fair competition gave us one important factor which has been lacking and which was vital to recovery, namely, the Federal Government as an arbiter of allowable crude oil production among the several states.

Daniel J. Sweeney, president of the association, presided at the meeting at which the following directors were elected: D. J. Sweeney, F. E. Richart, J. P. Harrick, O. W. Walchli, A. L. Shaner, John Messer, George W. Holbrook, Lewis H. Thornton, W. N. Davis, R. B. Moore, H. E. Goodrich, John Bradley, Alwin Schaller, F. D. Dorn and J. K. Cochran.

C. L. Suhr, president of the Pennzoil Co., and E. C. Breene of the Pennsylvania Grade Crude Oil Association, attended the meeting.

Freight Rates on Oil May Be Subject of an Inquiry

OTTAWA, Ontario, Oct. 23.—It is intimated that the recently authorized schedule of freight rates on crude oil to western Canada refineries will be investigated by the federal board of railway commissioners here as a result of protests from small refiners and others interested in western Canada.

As interpreted by railway commission officials, the new freight rate embodies the principle of the through freight rate on wheat, under which the grain can be milled in transit. The new schedule provides a lower rate on crude oil where the refined product also is shipped by rail. This rate applies, however, only where a refinery ships out at least 65 per cent of the crude oil it takes in.

Small refiners in many instances have marketed their output within a limited area by truck, and they assert that the higher rate on their crude is discriminatory.

On the other hand, railway officials assert that the granting of the lower rate on crude where the refined product is not shipped by rail would defeat the purpose of the new arrangement, which is to encourage the further use of the railroads for shipment of refined products.

It is expected the railway commission's inquiry will be completed before the new rate schedule becomes effective early in November.

ATLANTIC REFINING GAINS

PHILADELPHIA, Pa., Oct. 23.—Atlantic Refining Co. and subsidiaries report for nine months ended September 30, 1933, net profit of approximately $4,708,500 after interest, depreciation, depletion, taxes, intangible development costs, etc., equivalent to $1.74 a share (par $25) on 2,696,642 shares of common stock. This compares with $4,248,000, or $1.58 a common share, in first nine months of 1932.

Application of Solvent Extraction Methods for the Improvement of Lubricating Oil Quality

By JOHN W. POOLE and J. M. WADSWORTH
Foster Wheeler Corp.*

Solvent-extraction processes may be classed in two groups. The first we might call solvent dilution; the second we could call true solvent extraction. In the first class come all processes which have been prominent in recent years as new methods for dewaxing neutral and residual lubricating stocks. To the minds of many people these solvent-dewaxing processes actually are true solvent-extraction methods. In order to clarify this and distinguish between the two classifications of solvent refining we may consider the theory underlying organic solutions.

Solvent-Dilution Extraction

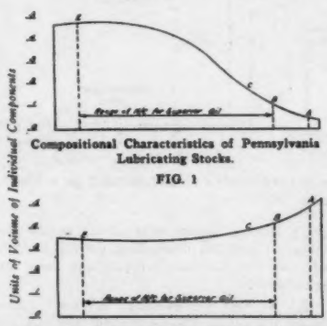
In general, organic solutions are different from inorganic solutions in that two different types of solution usually exist. For instance, if two liquids are mixed together in a suitable container, one of two things may occur. First, as we add the second liquid to the first, we may find that the second liquid becomes dissolved completely, forming only one phase—regardless of the extent to which this second material is added. On the other hand, we may find, when the second liquid is added to the first, that for an interval the same phenomena will occur, but that presently the first material becomes saturated with respect to the second, and that further addition of solvent results in the formation of a distinct and separate second phase. In many cases this phase is discernible in that the phases are of different specific gravity, the heavier tending to collect in the lower portion of the container. In such cases a sharp interface is usually discernible, especially if the two phases are not identical in color. In the case of organic solvents and those mixtures of hydrocarbons which are derived from petroleum to form the bases for lubricating oils, both of the above-mentioned cases may occur.

With solvent-dilution dewaxing processes, the condition is essentially that covered by the first of the above cases, i.e., only one true solution is formed. To this, the obvious reaction might be that two phases are formed; otherwise it would seem impossible to remove the wax from the oil in order to effect the object of the process. What actually occurs is, however, single phase, since one of the phases occurring in a solvent process for dewaxing may not properly be considered a solution. It is believed that the actual occurrence is as follows:

When such solvents as acetone, butyl alcohol, ethylene dichloride, or any one of the solvents capable of effecting the desired results is added to a wax-bearing lubricating stock, this solvent goes into solution in the liquid portion of the stock. It is an established fact that hydrocarbons upon passing from the liquid state to the solid state become far less miscible with organic solvents, regardless of the solvent. In many cases this reduction in miscibility may be insufficient to avoid liquefaction of the solid hydrocarbons in the mixture of hydrocarbons and solvent. Such solvent would, in consequence, be useless for dewaxing processes. On the other hand, there is unquestionably a vast number of organic liquids which are highly miscible in liquid hydrocarbons but which have extremely low miscibility with any hydrocarbons present that are below their melting points. This class of solvents may be said to be uniformly useful as dewaxing solvents—at least from the theoretical viewpoint. Their only purpose when added to the wax-bearing stock is that of diluents. Since they have little affinity for the paraffin waxes which are solid at the temperatures under which the process is operated, this wax will remain practically unaffected by their presence.

Moreover, if we choose one of the solvents highly miscible with the wax-bearing stock and which posseses considerable fluidity, the presence of this solvent will so reduce the viscosity of the liquid portion of the process material that the solid particles remaining essentially unchanged may be more readily removed from the solution. In short, the problem is purely one of mechanics.

Therefore, to sum up briefly, this type of solvent refining merely consists of diluting a mixture already comprising solid paraffins and liquid oil. The addition of the solvent merely serves the purpose of increasing the fluidity of the liquid portions so that these portions may be more easily strained, filtered, or centrifuged from the solidified wax. It is our belief that processes for precipitation of tar come within this classification of solvent separation, e.g., the laboratory method for the determination of tar, consisting of diluting the liquid constituents of the sample with petroleum ether so that they may be filtered from the semisolid tar.



Compositional Characteristics of Pennsylvania Lubricating Stocks.

FIG. 1

Fig. 2.—Composition characteristics of Mexican lubricating stocks. Paraffinicity increases from right to left

To illustrate solvent-dilution extraction methods we refer to Figures 1 and 2. Figure 1 represents a certain sample, for instance, one barrel of Pennsylvania stock. Figure 2 represents the same amount of an oil of the same boiling range from a Mexican source.

For simplification assume that the components of these two oils vary in hydrogen-carbon ratio, but not in boiling point. Those portions of each oil which are represented by the area at the extreme left of Figures 1 and 2 possess the highest possible hydrogen-carbon ratio. Those portions at the extreme right possess the lowest hydrogen-carbon ratio of all. The latter also contain an appreciable proportion of the sulphur and oxygen compounds, together with such materials as will form sludgy or gummy matter. All points intermediate between these two extremes will also be intermediate in hydrogen-carbon ratio.

Now, since the value of hydrocarbons as lubricants varies in more or less the same way as does hydrogen-carbon ratio, it will be true that as we move from right to left, we pass hydrocarbons of constantly increasing value, until we reach the point E in either figure. At this point the percentage of hydrogen has become so high, and the internal structure is such, that the hydrocarbons become solid paraffins; and, because they are solid, they must be rejected.

In both Figures 1 and 2 the area to the right of point A roughly represents such portions as present-day processes of acid and fuller's earth treatments tend to remove. The areas between A and B represent constituents of low hydrogen-carbon ratio, relatively high in sulphur, and which are scarce in Pennsylvania oils. It is due to their presence that Mexican lubricating and similar oils are often considered inferior to Pennsylvania oil. These materials are not readily removable by sulphuric acid or clay. Whereas they do exist in Pennsylvania oil, their volume is relatively unimportant, and is more or less lost in the large percentage of "paraffinic" material. We may say that the areas between E and A in the two figures represent the quantities and indicate the natures of the lubricants which could be produced from the respective sources by usual methods.

For this type of separation it is not necessary to choose a truly selective solvent. The only requirement is that we choose a solvent which is highly miscible with such materials as are represented in these two figures by the areas to the right of point E, and with such portions of the material to the left of point E as are liquid at the temperature of operation, but which very sparingly dissolves the solid materials to the left of point E. In consequence, as the temperature is reduced, more and more of the material to the left of point E will be reduced to temperatures below its melting point, and will become through this change of state insoluble in the diluting solvent which has been chosen. At the proper temperature this solid material may be centrifuged or filtered from the mixture of liquid hydrocarbons and dissolved solvent, thereby effecting a separation between solid and liquid components. That this is the type of action which actually occurs is borne out by a considerable quantity of unpublished data which is in our possession.

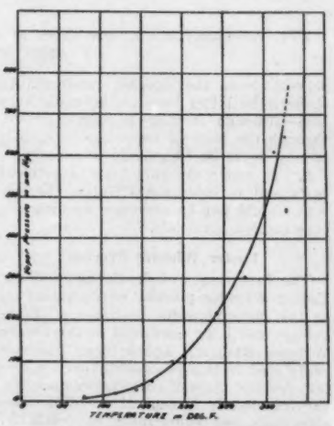


Fig. 3.—Vapor-pressure curve for 200-viscosity neutral oil containing 2% by weight of 2% bottoms of commercial-grade solvent "A"

For instance, if such a mixture is carefully filtered, the filtrate will be obtained in a clear and transparent condition—showing that no solid particles exist. Furthermore, after the filtrate has been freed of solvent, it has been found that, regardless of the solvent employed (provided wax of the type separated was sparingly soluble in this solvent), the resulting oil will possess a pourpoint essentially the same as the temperature of filtration. This point has been established with a considerable variety of solvents of all types including butyl and amyl alcohols, paraldehyde, ethylene dichloride, trichlorethylene, nitrobenzene, methyl ethyl ketone, bromobenzene, and many others.

True Solvent Extraction

The second type of solvent extraction, viz., true solvent extraction, may be said to be the direct opposite of the case just described in that the so-called solvent actually serves as a solvent rather than as a solute. In such a case it is necessary to choose a solvent which will not dissolve to a high degree in the "paraffinic" material of the charging stock. For example, if this material will become saturated upon the addition of 20 per cent of solvent, there will, at this point, develop the second or true solvent phase. In this latter phase there will, provided the solution is a suitable one, become dissolved certain portions of the original stock. As greater and greater amounts of solvent are added, the percentage of the original material which is dissolved will increase. When the total of the solvent selected has been added and thoroughly mixed with the charging stock, and the mixture allowed to settle, these two phases may be separated one from the other by mechanical means such as decantation. When this separation has been completed, there will be contained in one vessel the undissolved portion of the original material plus 20 per cent of solvent. In the other vessel there will be contained the remaining portion of the solvent, together with such portions of the original stock as have proved to be soluble in it. If the solvent is removed from both of these separated phases, obviously there will be segregated portions of the original raw material in separate containers. If, then, the solvent has been properly chosen, i.e., it posseses the quality of "selectivity" to a high degree, these two fractions will differ considerably from each other. Furthermore, the difference will be as follows:

The undissolved portion coming from the so-called oil phase will be constituted primarily of the more "paraffinic" materials which were originally present. The fraction produced by removal of the solvent from the true solvent phase will consist of materials highly "naphthenic" in nature or, in other words, of material of low hydrogen-carbon ratio, unsaturated compounds, hydrocarbon derivatives containing oxygen, nitrogen, and/or sulphur, etc.

In general, when a raw hydrocarbon material is mixed with a solvent, and there results from this mixing a segregation into two phases, each phase of which contains both oil and solvent, it will be found that the above types of raffinate and extract will be produced. However, the degree to which the raffinate will be "paraffinic" and the extract "naphthenic" will depend upon that quality which we choose to call "selectivity." If the solvent chosen is highly selective, the difference between these two materials will be great. If the selectivity is poor, the difference will be small; and, obviously, we may say that intermediate degrees of selectivity may be measured according to the degree of difference be-

*Presented before Chicago meeting, A.P.I., October 25 to 28.

tween the two products which are produced.

The solvent used by Foster Wheeler Corp. in its work possess selectivity to a very high degree which, when interpreted in terms of Figures 1 and 2, means that they possess an unusual ability progressively to dissolve hydrocarbons. They will most easily dissolve material at the extreme right of Figures 1 and 2; and, if we so desire, we can control them so as to dissolve material only up to point A, thereby taking out essentially the same material as is now removed by acid and clay. On the other hand, it is possible to control solution in such a manner as to dissolve all material from the extreme right to practically any point to the left, for instance up to point B. The solvent containing the dissolved material can be separated, as we have already shown from the portion remaining undissolved—leaving behind a lubricant which petroleum chemists cannot tell from that manufactured from Pennsylvania oil. In fact, if we so choose, we can produce in this manner an oil even more truly "paraffinic" than Pennsylvania oil merely by removing the material between B and, for instance, C. The point where we stop is purely one of economics, and each refiner will naturally decide that point for himself. The important fact is that it is possible to take raw material of which an abundance exists, and secure from it a high percentage of oil as good as, or even better, than the highest quality Pennsylvania product. It is also feasible to remove from a high-sulphur oil a large percentage of the sulphur and carbon-producing compounds. This method of solvent fractionation is of the type representing true selective solvent separation.

Choice of Solvent

A solvent must meet certain requirements if a resulting process is to be effective and economical. Nine such requirements are listed below, each of which is an essential for satisfactory operation. Simultaneously to satisfy all nine of these points is not a simple matter, especially since certain ones alone are satisfied by few organic solvents. These characteristics are so rare, in fact, that when viewed in connection with the other essentials, it is surprising that such things as satisfactory solvents exist at all. The nine prerequisites are as follows:

1. The solvent must possess much greater affinity for "naphthenic" material than the affinity which the paraffin compounds, comprising the oil phase, will possess in order that comparatively small volumes of solvent will be required. This means that the distribution ratio of "naphthenic" matter between solvent and "paraffinic" compounds will be high. Not only is a high distribution ratio important in order to reduce the volumes of solvent required, but also to reduce the number of contact stages in a commercial plant.

2. The solvent must possess low solvent power for "paraffinic" material, in order that the percentage of recovery of such material may be high.

3. The solvent must be relatively insoluble in the "paraffinic" material. Obviously such solvent as becomes dissolved in the oil phase will not be available for extraction from this phase. If extreme volumes are necessary to effect saturation of the "paraffinic" phase, a process using such a solvent will be forced to handle excessive volumes of material—thereby requiring large and expensive apparatus. Greater capital outlay will be necessary, and fuel costs for distillation recovery of solvent will also be increased.

4. The solvent under operating conditions must be chemically stable. If not stable, there will be an expensive loss of solvent due to its self-destruction. Furthermore, if chemically reactive, undesirable changes may be brought about in the final products.

5. The solvent should be relatively low boiling, in order that it may be easily and more completely recoverable. In dilute solutions the partial vapor pressure of a substance decreases directly with decreasing concentration. Certain solvents which possess high boiling points become very difficult to recover beyond 95 per cent, except under high temperatures. Necessity for high temperatures may result in degradation of the oil.

6. The solvent process must be operable under normal conditions of temperature and pressure. If the process is operable at normal atmospheric temperatures, the expenses of refrigeration or heating will be avoided. In order to operate at normal atmospheric pressure, the solvent must boil above the temperature of operation. From Paragraph 5 it follows, therefore, that the boiling range of suitable solvents is limited, probably between 90° F. and 225° F. We believe that the ideal solvent should boil in the neighborhood of 140° F.

7. The solvent must be nontoxic; i.e., it must exert no undesirable pathological effects on the operators, or be destructive of animal tissue.

8. The solvent should be relatively low in price. Regardless of whether the solvent is highly recoverable in any commercial plant, there must, of necessity, be losses due to leakage—and even due to the difficulty of recovering the last trace of solvent from the process products. In theory, the latter loss can be made very low—although it may be demonstrated, through the laws of vapor pressure, that it may never be completely eliminated.

9. In order to avoid high investment costs and maintenance charges, the solvent should not be corrosive to ordinary construction materials.

Since solvent "B" boils considerably lower than "A," it is the more attractive from the volatility standpoint; solvent "B" has not, however, been as much used in our commercial development as "A." The latter possesses distinct commercial uses other than solvent extraction; and is, in consequence, much more easily and cheaply obtainable. Although boiling at a higher temperature than solvent "B," it does, nevertheless, approach more closely in volatility characteristics the specifications of an ideal solvent than do other groups of selective solvents which we have investigated.

The following will show how well solvent "A" satisfies the nine requirements previously mentioned as requisites for a suitable solvent. In general, solvent "B" and other solvents in this group have similar physical characteristics.

1. Solvent "A" possesses greater affinity for "naphthenic" material than any other selective solvent which we have investigated. At a temperature of 68° F., the distribution ratio of "naphthenic" material with respect to solvent and a pure Pennsylvania neutral oil varies between 4 and 20, depending on the nature of the "naphthenic" materials used as standards.

2. At 68° F., solvent "A" only sparingly dissolves Pennsylvania neutral or bright stocks.

3. Solvent "A" dissolves in Pennsylvania bright stock to the extent of 10 to 15 per cent; in Pennsylvania neutral, to approximately 16 per cent.

4. Solvent "A," provided oxygen is excluded from the system, is very stable. This will be indicated by the degree of recovery which we have obtained as hereafter discussed under Paragraph 5.

5. In quantitative runs conducted under atmospheric pressure for the purpose of determining recoverability of solvent "A," we have been able to recover as high as 99.9 per cent of the solvent at maximum distilling temperatures less than 350° F., and 10 per cent of steam. A similar recovery has been secured by using an absolute pressure of 21 mm. and the same maximum temperature of distillation using no steam. Figure 3 is the vapor pressure curve of a 2 per cent solution of solvent "A" in a 250 viscosity at 100° F. neutral oil from which it is possible to calculate the distillation conditions necessary to reduce the solvent loss in the oil to the desired minimum.

6. Up to the present time we have never encountered a lubricating stock which required contact temperatures less than 60° F., and for many stocks efficient extractions can be performed at temperatures as high as 90° F.

7. Solvent "A," although possessing a disagreeable odor, is neither toxic nor destructive to animal tissues. The senior author and his assistant have worked more or less continuously in an atmosphere containing this solvent, and have never suffered any ill effects.

8. Solvent "A" is moderate in price. At present it is available at approximately 75 cents per gallon, and it is expected that the price will further decrease with increased demand.

9. Solvent "A" under conditions of operation is not corrosive. The pure solvent may be shipped or stored in steel containers. In the pure state the solvent does possess a peculiar ability to be slightly corrosive to brass or copper. However, this corrosive power is lost when as little as 2 per cent of hydrocarbon material becomes dissolved.

Table 1 gives the results which have been obtained on various types of crude lubricating distillates and residual stocks. To a considerable degree this tabulation is self-explanatory. Run 1 shows the original stock and the products resulting from a 120 per cent, three-stage, countercurrent treatment of a Mid-Continent reduced pressed distillate. This material contained appreciable residual matter—probably as entrainment—and was, in consequence, very dark in color. The primary product was produced by treating the raffinate with 2½ pounds of acidified "filtrol." The secondary product was distilled from the extract, and then treated with 10 pounds of 1.84 acid for color. For comparison, the original stock was treated and filtered in the conventional manner with 10 pounds of 1.84 acid and 5 pounds of "filtrol" to produce an oil with a color equal to the finished raffinate. This comparison shows the marked improvement in gravity, viscosity index, and carbon residue secured with solvent "A."

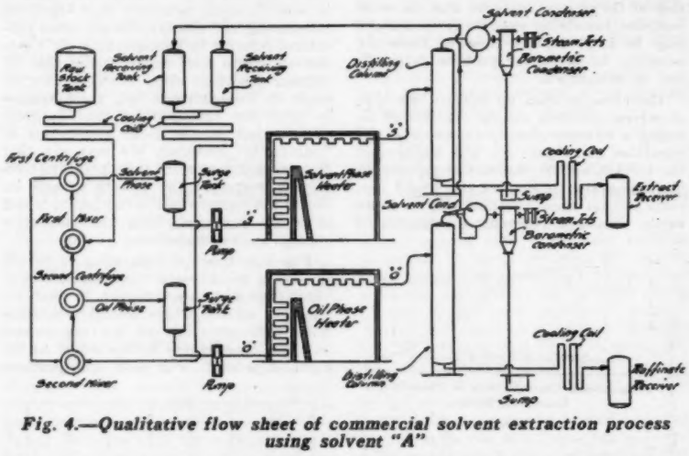


Fig. 4.—Qualitative flow sheet of commercial solvent extraction process using solvent "A"

Foster Wheeler Process

The first stages of development of the Foster Wheeler process were carried on at the Massachusetts Institute of Technology, and later continued in the Foster Wheeler Research Laboratory. The solvents used in this process comprise a certain definite class of chemical compounds, varying slightly in general chemical characteristics but appreciably in volatility. The two solvents that we have most highly developed are crotonaldehyde and acrolein which, for convenience, are designated as solvent "A" and solvent "B," respectively. Of course, the commercial grade of solvent will differ somewhat in characteristics from the chemically-pure compounds; these differences have not proved detrimental. We have, in fact, used commercial solvent in all of our recent development.

The physical characteristics of these two solvents, as taken from the Handbook of Chemistry and Physics, are as follows:

Crotonaldehyde (solvent "A"): C_4H_6CHO	
Molecular weight	70.07
Specific gravity	0.859 at 14° F.
Melting point	....*
Boiling point .....104-105†	
Acrolein (solvent "B"): CH_2:CH.CHO	
Molecular weight	56.05
Specific gravity	0.84
Melting point	....*
Boiling point	52.4° C.

*From our observation we know the melting point to be less than 0° F.

†We believe this somewhat high, and that the boiling point is around 103° F.

Since low boiling constituents can be dissolved more easily than those boiling higher, raffinates are frequently produced possessing higher flashpoints than did the original oil. The extract generally possesses a flashpoint at least as low as original stock. In this particular run the extract appears to have been raised 5 degrees. This was probably due to a slight vaporization of hydrocarbon material at the time the solvent was removed, by distillation. With regard to the ability to secure raffinates direct from the process—meeting commercial color and stability specifications—we have consistently been able to produce such colors, and have been able to produce a raffinate of greater than 200 viscosity at 100° F., with colors as low as 1-N.P.A. With very light acid and clay treatment in addition, we have produced from such raffinates oils of color corresponding practically to blank on the N.P.A. colorimeter. Such oils generally possess a slight bloom.

We have not been able to treat residual oils to color without the subsequent use of some acid or clay. Nevertheless, we have been able greatly to reduce acid and clay quantities over conventional practice, and have reason to believe we can eventually reduce this auxiliary treatment to as little as one-half pound of acid and 5 pounds of "filtrol," or equivalent, per barrel of typical Mid-Continent raffinate of 100-150 viscosity at 210° F.

Briefly, our accomplishments with cylinder stock are these: In every case we have been able materially to improve viscosity index, reduce carbon residue, and decrease specific gravity of products by

Efficient Handling

However, the charging stock for Run 1 was not prepared especially for solvent extraction. Since there are incorrect ways and only one correct way of operating the process, there are certain precautions involving very little extra care and no additional expense which must be regarded if a distillate is to be efficiently handled by a solvent process.

Runs 2 and 3, on lubricating distillates produced from the same crude as was the raw material used in Run 1, show how color and carbon residue can be improved by properly processing the original stock. In neither of these runs was it necessary to give any auxiliary treatment of acid or clay after the solvent process. Colors of the raffinate as obtained directly from these distillates were, respectively, 1¾-N.P.A. and 2¾-N.P.A., and the carbon residues were extremely low. It will be noted under Run 2 that the flashpoints of both the primary product and the extract have been raised. This may be due to either one or both of two reasons.

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solvent extraction and subsequent filtering, or combined acid and clay treatment, for final color. With yields of around nine-tenths of that by conventional methods, we have increased viscosity indices as much as 30 points, decreased carbon residue by more than one-half, and raised the A.P.I. gravity by 3 degrees. Runs 4 and 5 illustrate definite examples of treatment of cylinder stocks, where solvent extraction constitutes a step in the process.

Extracts Produced

In Run 4 two products were prepared from a Mid-Continent residuum. One was treated by conventional practice with 30 pounds of 1.84 acid per barrel for a sludge loss of approximately 28 per cent. The other was subjected at 68° F., to 200 per cent two-stage counter-current flow of solvent "A." Extracts equal to 23 per cent of the charge were produced, being asphalts of extremely high ductility. Also 8 per cent of ceresin wax was centrifuged from the oil phase before the solvent was removed. The removal of ceresin was made possible by the increase of fluidity due to the presence of dissolved solvent (an example of solvent dilution). This partially dewaxed raffinate was then treated with 10 pounds of 1.84 acid per barrel, equivalent to about 7 pounds of acid based on the original charge; resulting in the production of a stock for filtering equal to approximately 50 per cent of the original charge, as against 72 per cent in the previously mentioned case of acid treatment alone. If we consider that this 72 per cent yield includes 8 per cent of ceresin (equivalent to that removed in the solvent step) we should have 64 per cent of filterable oil by the conventional method as compared to 50 per cent by the solvent method. These two filterable oils were each contacted at a comparatively low temperature (400° F.), using 29 pounds of "filtrol" on the basis of the original charging stock. The results on these two oils are shown in Table 1. It will be noted, as in Run 2, that the flash of the raffinate was improved over the original stock. No mention has been made of viscosity indices on these oils, since the presence of wax crystals cause low temperature viscosities to be inaccurate and, in consequence, similarly affects the viscosity index.

In the case of Run 5 the primary product was produced by the subsequent use of 10 per cent of acidified "filtrol." The original stock could not be treated by acid to form a separable sludge. Quantities of clay of greater than 40 per cent would have been necessary to produce the same color on the original stock as was produced on the raffinate with only 10 per cent of "filtrol."

Runs 6 and 7 give partial data on the solvent treatment of certain California lubricating stocks which were not produced by the proper methods necessary to secure improved colors and carbon residue from the solvent treatment alone.

Run 8 shows a California distillate produced when such precautions were regarded. We regret that we do not possess more complete data on California products, but it is evident from the tabulation that it is possible to produce oils of high viscosity indices from this source.

Effect Desirable Results

Due principally to a high yield of oil of considerably increased viscosity index, results from Mid-Continent stocks are generally more impressive than those from other sources. On the other hand, the Foster Wheeler laboratories have found it possible to effect desirable results with practically all classes of oil. For instance, with oils from the Pennsylvania Field, it is often possible to increase viscosity indices as much as 20 points without extracting more than 10 per cent. Furthermore, the naturally high carbon residues of this type of oil will be considerably reduced by such treatment, and filtering costs will also be reduced. From oils highly "naphthenic," such as California stocks, it is possible to produce raffinates of greatly improved viscosity index—approaching, if necessary, that of Pennsylvania products. On raffinates from California neutrals the carbon residue is extremely low, providing the original distillation has been reasonably well done—usually being reportable as only "a trace." Yields are, of course, low.

Since solvent extraction is purely a separatory process, it is only possible to recover such highly "paraffinic" oil as originally existed. Furthermore, with treatment wherein it is necessary to use high percentages of solvent in order to remove extracts of considerable volume, there will of necessity be a higher proportionate loss of the "paraffinic" material by solution in the solvent phase. All hydrocarbons are somewhat soluble in selective solvents, although varying greatly in degree. To secure a 50 viscosity index oil from California distillate of from —30 to —40 viscosity index, it is necessary to accept a raffinate yield of under 50 per cent—using from 250 to 350 per cent of solvent. To increase further the viscosity index of such raffinate gives even lower yields, which are often so low as to be disproportionate to the gain in quality. Probably to secure an oil of 100 viscosity index, it will be impossible to secure yields much greater than 20 per cent of the original stock.

Among other types of oil which are found to be materially improved by the solvents and solvent process developed by Foster Wheeler are high sulphur oils. Such oils will be affected with respect to gravity, flash, viscosity, carbon residue, color, etc., in the same way as would similar oils more or less free from sulphur. In other words, sulphur is a problem quite independent of other characteristics. The effect of proper solvent extraction on high sulphur oils is drastically to reduce their sulphur content. As an example, consider the treatment of a reduced pressed distillate of about 250 viscosity at 100° F. produced from Mexican Tecomate crude. This distillate contained slightly over 3½ per cent of sulphur by weight. An extraction with solvent "A" removed approximately 15 per cent as extract, and produced a raffinate of 2.5 per cent sulphur; while an extraction removing 25 per cent as extract reduced the sulphur content to 1.6 per cent by weight, and doubtless the reduction could have been carried further. On the same sample 35 pounds of 100 per cent acid reduced the sulphur to 2.3 per cent, after which point the sulphur content was little affected by further acid—although a total of 100 pounds per barrel was used. The 75 per cent yield of raffinate, containing 1.6 per cent sulphur, was nearly as high as that secured by treatment with 35 pounds of acid (78 per cent). The viscosity index was 30 points higher, the color was lighter, the carbon residue reduced, and the resistance to emulsion appreciably improved.

Flow Chart of Process

In order to show briefly the principles which comprise the technology and operation of the Foster Wheeler extraction process a diagrammatic flow sheet for two-phase counter-current flow is shown in Figure 4. Regardless of which solvent, "A," "B," or "C," is used, the flow sheet applies. Between these three solvents the main differences will be solely the temperature to which the two heaters must raise the oil and solvent phases to effect vaporization of the solvent.

In Figure 4 lines marked O transport either oil or the oil phase; lines marked S transport either solvent or the solvent phase; lines marked E transport the extracted portion of oil, freed from solvent.

The operation is as follows: From the storage tanks for raw stock and solvent, these two materials are simultaneously and continuously passed through the temperature control coils to mixers 1 and 2, respectively. Each of these mixers, after effecting intimate mixing between such materials as are admitted to them, discharges the mixture continuously to the corresponding centrifuge which, by the well known principles of centrifugal force, separates its charge into two homogeneous phases. From centrifuge 1 the solvent phase or spent solvent is discharged to heater S, while the oil phase, thus partially refined, passes to mixer 2. Here it is contacted with fresh solvent; and the mixture, as before, is discharged to centrifuge 2. Again, the centrifuge separates its charge into two phases. The oil phase now completely refined goes to heater O, and the solvent phase or partially-spent solvent discharges to mixer 1, where its remaining extraction power is utilized. By such counter-current flow there result considerable economies in solvent qualities as well as in recovery of the available paraffinic bodies. By the use of centrifuge, instead of settling tanks, phase separation is greatly speeded up—proportionately shortening the cycle for solvent reuse. In this manner it was found in a plant designed by Foster Wheeler only a few barrels of solvent (exclusive of standby storage) were necessary for each 120 bbls. of raw stock handled per 24 hours.

From the heaters the two phases pass to their respective vaporizers; from which the vaporized solvent passes to condensers from which the solvent is returned for reuse. The residual material from the two vaporizers comprises the finished products which pass, either directly or through coolers, to finished oil storage.

It will be evident from the description of the operation that all of the plant equipment is more or less standard and broadly used in the industry, and that no difficulties are presented in the selection of materials for construction.

Summary

In this paper we have tried to give a brief, but comprehensive, idea of the possibilities of solvent extraction.

To summarize, with true solvent extraction it is possible to produce, from comparatively low-grade stocks, oils of low specific gravity, high viscosity index, and lowered carbon residues, and which in the case of neutral oils will not require subsequent acid or clay treatment to meet commercial color specifications. Such a process, being merely a separatory method, will not produce waste products such as sludge and, therefore, will not destroy material. The use of the Foster Wheeler process of solvent extraction will often enable a refiner to produce and utilize in some form products equal to 100 per cent of his original material.

It is probable in the near future this method of utilization of organic solvents for petroleum refining will become one of the most important methods of refining and, for that reason has already become of paramount interest to the petroleum refiner.

TABLE 1—COMPARISON OF PROPORTIONS OF ORIGINAL AND FINISHED OILS PREPARED BY FOSTER WHEELER SOLVENT-EXTRACTION PROCESS VERSUS CONVENTIONAL ACID-AND-CLAY TREATMENT

Material—	Yield (Per cent)	Solvent (Per cent)	Temp (°F.)	Grav. (°A.P.I.)	Fl. P. (°F.)	Fr. P. (°F.)	Viscosity Saybolt U. at: 100°F.	210°F.	Vis. index	Pr. P. (°F.)	Color (N.P.A.)	Carbon residue Per cent	Steam Emulsifaction No.	Remarks
Run No. 1:														
Mid-Continent reduced pressed distillate	...	...	.....	25.2	425	485	312	50	66.3	20	4½ dilute	0.3	...	
Primary product	±81.0	120	65–70	30.4	425	485	227	48	96.0	35	3	0.025	30	
Secondary product	8.5	...	.....	19.0	430	480	530	55	25.5	15	8	...	...	
Residual extract	8.0	...	.....	11.0	...	...	plus 2,000	76	....	30	black	...	...	
Original stock, after acid-and-clay treatment.	±88.0	...	.....	26.0	425	485	285	49	69.0	30	3	0.05	60	10 lb. acid, 5 lb. "Filtrol" based on original oil
Run No. 2:														
Midcontinent neutral distillate	....	...	.....	27.5	365	430	128	...	....	25	4½ unstable			
Primary product	73.0	140	75	31.8	380	430	115	...	....	30	1¾	0.21	...	
Extract	27.0	...	.....	16.4	370	440	275	...	....	15	4½ dilute	Trace	60	
Run No. 3:												...	...	
Mid-Continent neutral distillate	....	...	.....	24.9	420	500	316	...	....	30	7½	0.28	...	
Primary product	75 0	140	60	29.5	420	500	262	...	....	30	2¾	0.02	...	
Extract	25.0	...	.....	13.1	415	500	1,560	...	....	20	7½ dilute	...	...	
Run No. 4:														
Mid-Continent residuum	....	...	.....	19.0	520	590	...	305	....	...	black	7	...	
Primary product	59.0	200	68	24.5	540	590	...	202	....	50	7½	0.85	...	7 lb. acid, 29 lb. "Filtrol" based on original oil
First extract	16.5	...	.....	....	...	...	...	...	....	...	...	...	...	
Second extract	6.5	...	.....	....	...	...	...	...	....	...	...	...	...	
Ceresin (melting point, 160° F.)	8.5	...	.....	....	...	...	...	...	....	...	...	...	...	
Original stock, after acid-and-clay treatment.	72.0	...	.....	24.1	520	590	...	218	....	100+	7½	2 36	...	30 lb. acid, 29 lb. "Filtrol" based on original oil
Run No. 5:														
Pennsylvania residuum	....	...	.....	24.2	600	670	4,230	229	96.5	...	black	...	...	
Primary product	89.5	...	...	26.0	...	...	3,300	206	107.5	...	...	...	...	
Filtered product	....	...	.....	....	...	...	...	...	....	...	5½ dilute	...	...	
First extract	6.5	...	.....	7.6	...	...	...	...	....	...	black	...	...	½ lb. acid, 10 per cent "Filtrol"
Second extract	4.0	...	.....	12.4	...	...	...	...	....	...	black	...	...	
Run No. 6:												...	...	
California distillate	..	...	.....	16.8	465	...	1,120	69.8	—34	....	...	...	...	
Primary product	50.0	300	60	23.6	495	...	712	63	43	...	...	...	...	
Extract	50.0	...	.....	....	...	...	...	...	....	...	...	...	...	
Run No. 7:												...	...	
Treated California residuum	....	...	.....	19.9	480	..	1,074	76.8	47	...	...	...	...	
Primary product	55.0	275	80	25.1	490	...	726	72	90	...	...	...	...	
Secondary product	31.5	...	.....	17.8	...	...	238	46.2	9.5	...	...	...	...	
Extract	13.5	..	.....	asphalt, about 100 degrees penetration								...	...	
Run No. 8:														
California distillate	...	...	.....	22.4	...	...	322	50 6	67.1	...	...	...	...	
Primary product	55.0	275	60	28.0	...	...	229	48.2	97.8	...	"	Trace	...	
Extract	45 0	...	.....	....	...	...	...	...	....	...	...	...	...	

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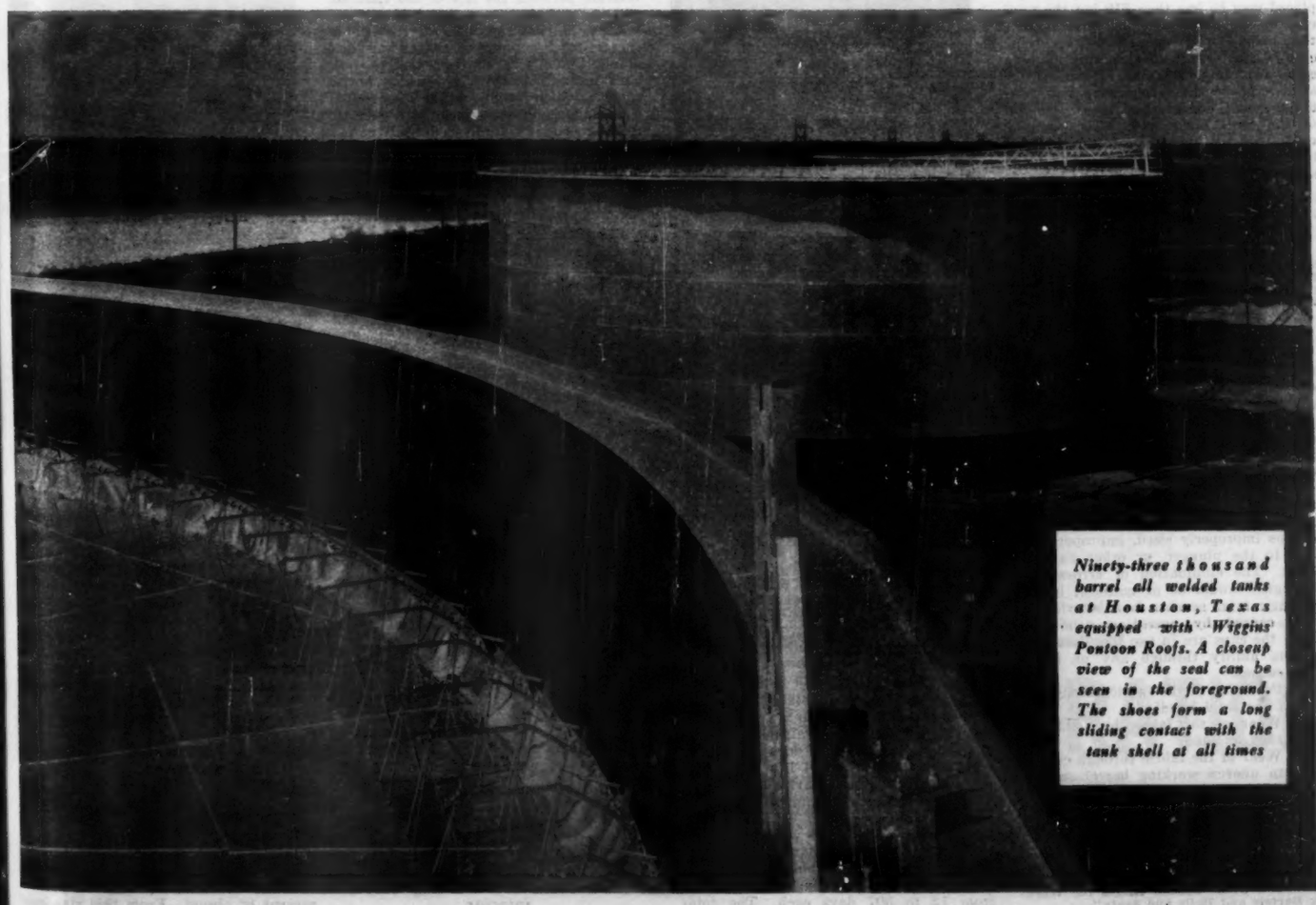

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Field and Laboratory Data Covering Tests Upon Special Alloys for Barrels, Balls and Seats

By WALTER F. ROGERS
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A common method of pumping oil wells is by means of a sucker-rod system composed of a common working barrel and four-cup traveling valve. It is the purpose of this paper to discuss some of the operating characteristics of such pumps, with particular reference to the common working barrel and to show how an economic increase in the service life of working barrels may be obtained through the use of recent advances in pump manufacture.

The type of valve used with the working barrel and with the plunger is also an item of importance. The high labor cost of pulling the rods and tubing from a well as compared with the cost of the ball and seat makes it advisable that a valve capable of giving a long service life be used. Numerous experiments have been made with special alloys made up as this equipment, and the results of a few tests of this nature are outlined in this paper.

Special Alloys Suitable for Pump Parts

It is realized that these brief data on working barrels and balls and seats are rather sketchy. It is primarily intended to point out the fact that tests on new materials of construction for the various items of well equipment are resulting in improvements. The development of more serviceable working barrels is of particular importance. It is felt that some progress along this line has been made through the development of the stainless steel lined barrel. In the past, balls and seats have been the source of some pumping equipment troubles. The use of chromium-iron and chromium-nickel-iron alloys for this purpose have resulted in a marked reduction of expense from this equipment. The use of these alloys, plus the fact they may be reground and reused, makes ball and seat replacements of negligible expense in most fields.

Analysis of Failures of Working Barrels

The initial material cost of the common working barrel and cup-packed plunger is but a fraction of the expense involved in its use. Each time the cups are changed the value of the equipment replaced may be less than $1, but the total labor used is five to six times this amount. When the working barrel is changed the value of the equipment replaced may be less than $10 but the total cost of the labor is again several times this amount. The constantly recurring cup jobs necessary to keep the pumping equipment in good condition makes the sum total of these numerous but relatively small charges the major portion of the total lifting cost of a pumping well. It is not uncommon to see the total lifting charges for a pumping field to be apportioned as follows:

Type of trouble—	Per cent of total lifting cost
Pumps	52.75
Working barrels	
Cups	
Balls and seats	
Sucker rods	17.44
Total surface equipment	15.62
Tubing	12.25
Miscellaneous	1.94
	100.00

Although these figures are only for one month of operation they are typical of pumping fields where cups and working barrel systems are used. It is seldom, if ever, in these fields that pump costs drop below first place. It is evident from these figures that the subject is worthy of extensive study.

Failure of the cups on the traveling valve may be due to any or all of several reasons. These include initial defects such as cups improperly sized, improperly applied to the plunger, or other handling errors. The elimination of errors from this cause would be of material benefit but their total number is subservient to those caused by operating conditions. When the cups are in use they lose their packing ability through any or all of three causes.

1. Softening of the fabric through action of the fluid handled.
2. Wear of the fabric by solid particles such as sand.
3. Wear of the fabric through contact with an uneven working barrel surface.

The resistance of the cups to failure from the first two causes is primarily a function of the composition and construction of the cups. Resistance to failure from the third cause is also a function of the composition and construction of the cups to a certain extent but is more dependent upon the corrosion and abrasion resistance of the barrel used. Thus, it is seen that the life of the cups on the traveling valve is obtained in two stages, the first under conditions of ideal barrel surface when the barrel is new; the second begins with the development of a

Fig. 1.—Worn working barrel interior

roughened barrel interior. This development of roughness may be caused by either or both of:

1. Sand wear against the barrel surface.
2. Corrosion attack of the barrel surface by the fluid produced.

During this stage the combination of fluid and barrel attack results in a decreasing amount of service obtained from the cups and consequently in an increase in lifting costs.

Field Data

Data have been obtained from nine typical Gulf Coast pumping wells to show how the service life obtained from cups changes with each set of cups used in the same barrel. The barrel life is the sum of the service given by all the cups shown in the first column of the accompanying table.

The nine wells from which the data were taken produce quantities of fluid ranging from 20 to 497 bbls. per day. The total life of the working barrels range from 12 to 307 days each. The total number of sets of cups used with each barrel range from 5 for the barrel with the shortest life to 20 for the barrel with the longest life. It will be noted for each barrel that the trend is for each succeeding set of cups to give a slightly less life than the preceding set. This tendency continues until it becomes uneconomical to continue to use the barrel. This gradual decrease in the life given by succeeding cup sets can be attributed only to changes in the working barrel surface.

A table has been prepared to show the relation between the life of the first set of cups and the succeeding sets. It will be noticed that the ratio of the life of the first set of cups to the average life of all the cups varies from 1.13 to 4.64. This means that with a working barrel surface which would retain its original condition the life of the cups would remain at one level for each well rather than tapering off as shown by this ratio. This variation in service life of 4.64 to 1 is indicative of the necessity for developing a more corrosion and abrasion resistant barrel than those used at present.

Figures 1 and 2 show the appearance of the interior of used working barrels. Figure 1 illustrates the typical condition of a barrel which obtains its increase in surface roughness through abrasion from the cups and the fluid handled. The evidence of roughening is very slight. The

Fig. 2.—Corroded working barrel interior

majority of barrel replacements have this appearance when split open for inspection. Figure 2 illustrates the typical condition of a barrel which obtains its increase in surface roughness through corrosion attack of the fluid handled. It will be noted in this case that the surface of the barrel has been extremely roughened. A set of cups used with this barrel would pump properly only a few hours.

Special Materials for Working Barrels

During the past few years several special materials of construction have been tried for use as working barrels. These special materials have included both solid metal and plated surfaces. It has been found in testing equipment of this nature that the true value of the material cannot be obtained from the results of a single test. It is only after a number of test results have been accumulated that any dependence can be put in the data. As a consequence a great deal of time and effort is required to determine the characteristics of any piece of equipment. This has prevented studies from being made on more than a limited number of materials. The first procedure was to choose from the known data those materials which possessed high abrasion and corrosion resistance and which could be fashioned into working barrels at a moderate increase in cost over the common cold-drawn steel barrel. It was possible to select the more corrision-resistant materials from tests which had previously been conducted by the laboratory under oil field brine conditions. It was necessary to consult the literature for information regarding the abrasion resistance of these alloys. From the standpoint of corrosion resistance under both hydrogen sulphide and nonsulphide conditions the various classes of metals and alloys may be listed in the following order:

1. Nickel.
2. Chromium-nickel alloys.
3. Brass and bronze.
4. Steel and iron.

Nickel and some nickel alloys are quite resistant to corrosion attack from oil field brines either when hydrogen sulphide is present or absent. From this standpoint

Fig. 3.—Corroded exterior of insert pump barrel

*Before the Topical Committee on Metallurgy and Corrosion of Oil Field Equipment, A.P.I., Chicago, October, 1933.
Author's title, "Special Alloys for Working Barrels and Balls and Seats."

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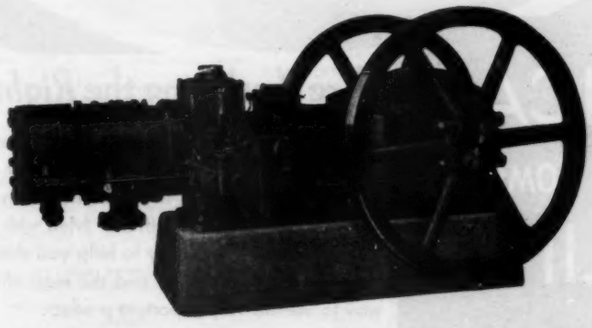

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this metal is highly satisfactory. Unfortunately, its abrasion resistance does not seem to be of the same quality as its resistance to corrosion. Only two tests of a nickel barrel have been made and although the test results are not encouraging this amount of data is insufficient to condemn the metal. Two nickel barrels were obtained to work with an insert type pump using coiled flax for packing. In these tests the nickel tube gave a service of 110 days, while the plain steel tube, also used with flax packing, gave a service of 171 days. In addition, it was necessary to repack the nickel tube every 27 days while the steel tube was repacked every 39 days. These

Fig. 4.—Non-corroded chromium plated interior of barrel shown in Figure 3

tests have perhaps given a clew to the value of nickel for this service, but the test data are still too meager to warrant definite conclusions.

The chromium-iron and chromium-nickel-iron alloys are also quite corrosion resistant to nonsulphide bearing oil field brines. If hydrogen sulphide is present these alloys are sometimes deeply pitted although this does not always occur. The greatest amount of corrosion from hydrogen sulphide-bearing oil field brines is obtained in wells which produce a small quantity of fluid daily. In this case it seems that air contaminates the fluid being produced and gives rise to a high

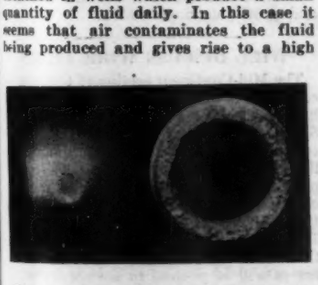

Fig. 5.—Corroded tool steel ball and seat after 15 days service

corrosion rate. In fields which produce large quantities of hydrogen sulphide-bearing brine little or no corrosion attack is obtained irrespective of the hydrogen sulphide concentration.

Stainless Steel

Particular attention has been paid to a ferrous alloy of 18 per cent chromium and 8 per cent nickel. This material may be obtained under several trade names. Its marked properties of corrosion and abrasion resistance makes it particularly suitable for working barrel service. A working barrel formed from this material was obtained in 1930 for test. It was installed in a well producing corrosive fluid and used with a four-cup traveling valve. The results of this test were encouraging

RELATIVE LIFE OF FIRST AND SUCCEEDING SETS OF CUPS

Well—	Total bbl. service (days)	Average life of each set of cups (days)	Life of first set of cups (days)	Ratio of first set to average cup life (days)
A	12	2.4	5	2.08
B	110	8.4	13	1.15
C	34	6.8	24	3.53
D	52	13.6	31	2.28
E	185	23.1	33	1.43
F	271	30.1	34	1.13
G	65	10.8	36	3.33
H	159	22.7	70	3.09
I	307	15.3	71	4.64

as the barrel gave a service life 2.58 times as long as the common steel barrel used in the same well.

The high cost of the solid 18-8 stainless steel barrel made its use inadvisable. In order to reduce the cost a composite barrel has been developed. This barrel consists of a tube of polished 18-8 stainless steel, approximately one-sixteenth inch thick, cold pressed in a steel jacket. The assembly is manufactured to A.P.I. working barrel specifications. Three of these composite barrels were installed for test in the summer of 1931 and two of them are still in use. This unusually good service indicates that a major advance in working barrel manufacture has been made.

As an example of the efficiency of these working barrels the data which have been

Fig. 6.—Failure of bronze ball from hydrogen sulphide attack

obtained in testing them against common working barrels are given:

18-8 STAINLESS STEEL LINED WORKING BARREL NO. 1

Well "A"—Texas Gulf Coast (Nonsulphide Brine)

	Days
Average life of each of four common working barrels used before the 18-8 stainless steel lined barrel and two working barrels used after its test.	83.6
Average life of cups used with these six working barrels	11.2
Life of 18-8 stainless steel lined working barrel before being transferred to Well "B"	141.0
Average life of cups	20.1

Well "B"—Texas Gulf Coast (Sulphide Bearing Brine)

Average life of cups used with previous common working barrel	13.6
Service to date of 18-8 stainless steel lined working barrel exclusive of 141 days' service in Well "A"	201.0
Average life of cups	33.5

18-8 STAINLESS STEEL LINED WORKING BARRELS NOS. 2 AND 3

Well "C"—Texas Gulf Coast (Nonsulphide Brine)

Average life of two previous working barrels	53.0
Average life of cups	8.1
Life of 18-8 stainless steel lined barrel No. 2	156.0
Average life of cups	11.1
Life of next common working barrel.	64.0
Average life of cups	8.0
Life to date of 18-8 stainless steel lined barrel No. 3, excluding 40 days' previous service in another well	296.0
Average life of cups	13.4

These data show that the average life of the three 18-8 stainless steel lined working barrels to date is 280 days, and two of them are still running. This may be compared with the average life of nine common working barrels used in the same wells of 74.9 days.

In addition, the average life of cups used with the common working barrels was 11.7 days, and the average life of cups used with the lined barrels was 19.5 days.

Chromium Steel

Chromium metal has long been known to possess a very high resistance to both corrosion and abrasion. For several years attempts were made to successfully chromium plate common working barrels. The test results in these cases were entirely dependent upon the type of plating job obtained. If the plating was free from pin holes an extension in service over a nonplated barrel was usually obtained. In the majority of cases, however, the coating peeled or became worn from the barrel walls because of faulty application. This resulted in an unsatisfactory life for both the barrel and the cups used in it.

Recently, chromium plated tubes for insert type pumps have been obtained which have shown a high degree of resistance to these faults. Figures 3 and 4 show the corrosion resistance which can be obtained by the use of a properly chromium plated barrel. Figure 3 shows the corroded exterior of the steel barrel; Figure 4 shows the noncorroded chromium plated interior of the same barrel. The high cost of these chromium plated barrels makes it inadvisable to use them under all conditions. Under severe conditions of corrosion or with excessive sand in the fluid they may be used to advantage.

The development of the 18-8 stainless steel lined common barrel and the chromium plated insert type barrel constitute

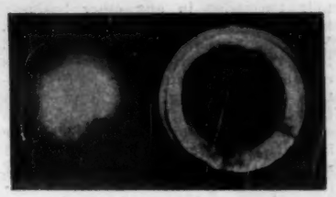

Fig. 7.—Failure of bronze ball and seat from sand cutting

the two main recent improvements in corrosion and abrasion resistance for oil well pumps. It is believed that in particular the development of the lined barrel will be found to be of great use in the future.

Balls and Seats

As pointed out previously, it is important that pump valves be made of as serviceable materials as possible in order to prevent unnecessary rod or tubing jobs to replace this item of equipment. There are, at present, a number of high grade pump valves on the market. It is only possible at this time to consider in general the service given by balls and seats constructed of the more popular materials, and in addition present a few results on tests of special alloys. In general, it may be said that the use of the higher grade pump valves has reduced the replacement costs of this equipment to a very low figure.

The standard alloys used in the manufacture of balls and seats are:

(1) Tool steel, (2) commercial bronze, (3) chromium and chromium-nickel alloys.

Originally, tool steel balls and seats were almost universally used for pump valves. In shallow wells producing noncorrosive fluid they gave a very satisfactory life. With the development of deeper fields and the production of corrosive fluids and fluids heavily laden with sand these balls and seats failed rapidly from sand cutting or corrosion. Figure 5 shows a badly corroded tool steel ball and seat after 15 days in a well producing corrosive fluid. The low initial cost of these tool steel balls and seats prompts a good many operators to use them. In addition to the disadvantage of short life under certain conditions, when they are replaced they have little reclaim value. This reclaim value has been found to be an important item and will be discussed in greater detail later.

Bronze Balls

The commercial bronze balls and seats possess certain advantages which make their use advisable under special conditions. They are of especial advantage where it is necessary to use a nonmagnetic valve. It has often been found that a tool steel ball and seat would not function properly because of the development of magnetic forces in the tubing. In these

Fig. 8.—Corrosion attack of stainless steel ball and seat

cases the substitution of a bronze valve will stop the trouble. These bronze balls and seats have the added advantage of being highly corrosion resistant to non-hydrogen sulphide bearing brines. In hydrogen sulphide bearing brines their use is not advisable. This has been found to be particularly true in the Bruner Field, Luling, Texas. In this field the wells produce large quantities of hydrogen sulphide bearing brine. The fluid is not corrosive to the rods and tubing but causes rapid corrosion attack of bronze balls resulting in pitting and fracture of the ball.

Figure 6 illustrates a bronze ball used with a stainless steel seat. It will be noted that the ball shows lines from pounding, pits from corrosion and has been split in two, presumably from a combination of corrosion and em-

Fig. 9.—Embrittlement failure of stainless steel ball and seat

brittlement. The lack of abrasion resistance of these bronze valves has also aided in keeping their use from being very extensive. Figure 7 shows a bronze ball and seat which was sand-cut to destruction. In spite of these drawbacks, bronze valves are sometimes found to be very economical to use. Their use is, however, rather restricted and they do not enjoy wide popularity for general service.

Stainless Steel Balls

The stainless steel balls and seats have been found to be the most satisfactory type to use. Their initial cost is several times that of tool steel balls and seats

but their service life justifies this increase under most conditions. These alloy valves possess a very high resistance to abrasion and corrosion attacks. In fields which produce noncorrosive fluid they frequently give a service of from several months to several years. Their general ability may be appreciated from the fact that replacements from over 500 wells producing a wide variety of fluid averages 80 valves per month. There are, of course, a number of wells which are repeated offenders in this respect, but considering the total number of valves in service this average life is quite satisfactory.

These stainless steel valves are subject to a certain amount of sand cutting, corrosion attack, and embrittlement, although they do not usually show any evidence of failure through pounding. Failures through sand cutting are about half of the total. Direct corrosion attack is responsible for a very few failures. Figure 8 shows a stainless steel ball and seat replaced on account of corrosion attack. This type of attack is almost always obtained when the well produces a small quantity of fluid daily and it contains hydrogen sulphide. In this case it seems that air contaminates the fluid and accelerates the corrosion attack. This action has been pointed out previously in regard to stainless steel.

The most serious trouble with these stainless steel balls and seats has been obtained in the Bruner Field, Luling, Texas, which produces large quantities of sulphide bearing fluid, having an unusually rapid action on stainless balls and seats in the same manner as bronze balls are affected. The fluid attack takes the form of rapid embrittlement of the metal. Little or no visible corrosion takes place but the balls and seats begin to chip and must be replaced. (See Figure 9.) In addition to these visible fractures close examination usually discloses hair line cracks passing around the edge of the seat and which ultimately result in further breakage. The attack is evidently due to hydrogen embrittlement but why it should be so severe in this field is not known. It is the usual procedure to change the traveling valve ball and seat every 30 days. Although a number of tests have been made, no satisfactory means has been found for successfully eliminating this trouble.

One of the most valuable features of stainless balls and seats is their high reclaim value. Usually when these materials are replaced they show only slight damage, and often may be reground at a low cost. It has been found over a period of months that properly reground balls and seats of this material give a life equal to the new valves. The ability to recondition this equipment has reduced its already low cost to a negligible figure.

Aside from these three standard valve compositions a number of tests of other materials have been made. Under certain conditions some of the test materials gave excellent service; under other conditions they fell below the service given by the standard equipment. When the occasion demands, these test materials may be used under the condition for which they are most fitted. A summary of the test results given by these alloys follows:

Specially Hardened K-Monel Metal Balls and Seats

A number of sets of this alloy were installed in wells of various characteristics. These wells produced fluid both free from and containing hydrogen sulphide. In addition, they were tested in deep and shallow wells. It was found that this alloy could not be used in deep wells. In this case, the fluid weight was sufficient to pound down the seat and cause leakage. In shallow wells, i.e., 600 to 2,500 feet in pumping depth, the alloy gave excellent service. It was particularly good in the shallow wells (600 feet) which produce corrosive sulphide-bearing brine. In these wells the standard stainless steel alloy became seriously pitted in a few days. The K-Monel metal valve was untouched by corrosion attack and gave an excellent service. This alloy can apparently be used to advantage in relatively shallow wells which allow corrosion attack of valve equipment.

Nitrided Steel Balls and Seats

It is possible through the nitriding process to develop a very hard surface on steel. A number of nitrided valves were tested under varying conditions. The nitrided surface is not particularly corrosion resistant and it was found that the valves failed from this cause when used in wells producing corrosive fluid. Under other conditions, as where sand cutting was the primary cause of the trouble, a satisfactory service was oftentimes obtained. It seems, at the present, that nitrided balls and seats will sometimes give good service, but they cannot be used under all conditions.

Cyclops 17-A Balls and Seats

This alloy was tested in shallow wells producing hydrogen sulphide-bearing brine which is very corrosive to stainless steel valves. The Cyclops alloy gave splendid service under this condition. No tests have yet been made in deep wells or those giving rise to excessive sand cutting. The alloy is deserving of further trial under conditions of more mechanical strain.

Chromium Plated Balls and Seats

The abrasion and corrosion resistance of chromium plated surfaces makes this an ideal material for balls and seats. Unfortunately, the application of the coating is so often faulty that the full advantage of the coating possibilities are seldom obtained. Several sets of chromium plated valves were tried. In each case failure occurred within a fairly short time. The failure was due to defects in the coating application. Apparently the difficulties of chromium plating makes it inadvisable to use this type of ball and seat.

Should Automobile Specialties Be Sold at the Stations, and, If So, What Specialties?

By B. K. DAVIES
Standard Oil Co. of California*

The function of a gasoline station, as I see it, is to supply the motoring needs of its present or prospective customers. These needs originally were envisaged as being exclusively gasoline and lubricating oils. In fact, the entire concept of a "gasoline station" was first comprehended in the use of that designation, which, in some parts of the country, is now quite generally replaced by the name "service station"—perhaps a more nearly accurate description.

Gasoline and lubricating oils continue to constitute the backbone and mainstay of station operation. But from the viewpoint of the patron and the petroleum marketer alike, they no longer fill the bill. In fact, they never did.

Automotive transportation is more than gasoline and more than oil. It involves other services and goods, to a degree probably unequaled in any other business, but quite generally accepted in this one. Water for radiators and air for tires, to mention only two, are free services customarily given and accepted as essentials to motoring welfare. They are, in fact, no more essential than a lamp bulb on a dark night or a windshield wiper in a driving storm. All these things and many others go to make up the sum of the motoring operation. There is no logical mid-ground between a complete restriction of service to the actual sale of gasoline and oil, and its extension to include the reasonable requirements of the customer for the operation of his motoring equipment. The major maintenance of that equipment is another matter altogether.

What Are Essential Needs?

If we accept this view, our problem becomes simply the selection of those products, in addition to gasoline and oils, which round out the practicable limitations of motoring service. These products would appear to fall readily into two classifications, necessities and optional goods. Without attempting a complete listing, it seems reasonable to classify tires, batteries, spark plugs, fan belts, lamps, antifreeze and stop-leak preparations, fuses, tire chains and other like articles as necessities. Lacking them, the motorist cannot motor; and he is likely to need any of them any time. Beyond these, there is a wide range of optional goods: Goggles, dust cloths, flashlights, floor mats, friction tape, and so on indefinitely. As to whatever we decide to classify them as motoring necessities, it would seem that we are, in principle, pretty well committed to carry them if our gasoline station is to fulfill its function of supplying motoring needs. The decision here rests upon what we consider the essentials to be. As to optional goods, that is a different matter; and such goods cause much of the grief that is experienced in the marketing of specialties at gasoline stations.

*Before A.P.I., Chicago, Oct. 25.

This need not necessarily be the case. Every gasoline station is a potential laboratory; and a chain of stations, especially, furnishes a proving ground for the testing of almost any accessory, if we care to utilize it. There is no surer way to learn than by a test—wisely planned and carefully conducted and checked. And there is no easier way to be misled than through a test representing abnormal conditions. A new article, displayed and pushed, may easily show sales wholly out of line with its actual and permanent volume. Any test, to be of value, must represent the marketing of the product under natural and normal conditions.

Under any conditions, however, sales tests are indicative rather than decisive. The average car stands at the pump block perhaps four minutes. In that time the salesman must supply and sell his major products, gasoline and oil; and, generally, perform certain free services. The customer, it is true, has voluntarily exposed himself to sales solicitation—but he need not do so ever again! The available time, the importance of major products, the susceptibility of a motorist whose mind is always bent on getting out as soon as possible—all are factors of large importance in determining the extent and nature of the accessory line; and in these decisions experience and judgment enter to a high degree.

In truth, marketing at gasoline stations is something very different from what we generally consider to be the petroleum products business. It is a retail business, intricate to a degree, and divergent fundamentally from the processes of petroleum products selling. For its best success it requires, if not a different type of mind, at least a different type of personnel; different methods, different training, and different operation throughout. Naturally, also, different and specialized management. This is attained, in some instances, through separate companies, subsidiary to petroleum-marketing corporations. In any case, the cleavage is just about absolute in its nature and functions.

"Mind Your Own Business" a Good Plan

Anything can be sold at a gasoline station—hats, clothes, groceries, musical instruments, hardware—virtually any article of general use. Because this is true, there has been a great deal of sales experimentation in no way related to motoring requirements. When we consider the impossibility of selling even a full line of our own specialties in the fleeting moments during which the motorist is literally poised for flight, the advisability of straying into other pastures becomes at least questionable on any economic basis. "Mind your own business" is as good an axiom as ever—perhaps a better one today than ever before. No ultimate advantage is in sight for anyone through raiding, or trying to raid, other people's business. "A" may take from "B," who in turn purloins from "C," who transgresses against "D," who completes the circle by grabbing from "A"; but nobody is benefited, and all are hurt. The volume of trade is not increased. The consumer also is hurt; because he is best served, in every line, by the people who know how to do the job.

Because of the greater service rendered to the consumer, the wise merchandising of motoring necessities and conveniences definitely tend to augment the sales of petroleum products at gasoline stations. Established customers are better satisfied, and less inclined to switch around to other stations and other brands of gasoline. There is less, if any, necessity for sending customers to other sales outlets where their allegiance may be diverted. Additional customers are attracted, and made permanent, either by some chance stop or by display or word-of-mouth selling through other motorists.

The same wise methods produce substantial revenue and profit for the station, without increase in overhead or carrying charges, and with but slight increase in direct operating costs.

Automobile specialties should be sold at gasoline stations. The right specialties. Selected and merchandised with the utmost care and skill, in accordance with well-defined principles and painstaking methods of testing. The whole operation is one of delicate balance and adjustment. Continually practiced, and conducted under these conditions, it becomes a useful and profitable undertaking.

WILL DISCUSS WIRE LINES

The Mid-Continent section of the American Society of Mechanical Engineers will hold a meeting Friday, November 3, at 8 p. m., in the University Club Auditorium, Tulsa, on the subject of wire lines. This meeting will be open to all parties interested in the manufacture, construction, use and care of wire lines. H. F. Brindel, chairman of the Mid-Continent section, will preside and representatives of the various wire rope manufacturers will be present to answer technical and practical questions from engineers and oil field men.

MICHAEL McGUIRE DIES

MOUNT PLEASANT, Mich., Oct. 23. Heavy fog claimed the life of Michael McGuire as the car in which he was a passenger was wrecked Friday morning as he was on his way to work in the West Branch Field, Ogemaw County. He had worked in the Central West and Mid-Continent.

JACOB MESSER DIES

OIL CITY, Pa., Oct. 23.—Jacob Messer, 91, of Emlenton, father of Samuel Messer, president of the Quaker State Refining Co., died in the Oil City Hospital last week after an illness of several days. In 1884 he settled at Emlenton where he was engaged as an oil producer.

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Commercial Application of Chlorex Process in the Manufacture of High Grade Motor Oils

By W. H. BAHLKE, A. B. BROWN and F. F. DIWOKY
Standard Oil Co. (Indiana)*

The present symposium attests to the interest of refiners in developing lubricating oils which fulfill the exacting requirements of the modern automobile. A background of research has pointed out the characteristics necessary for oils to fulfill these requirements, and this research has resulted in emphasizing the following desirable characteristics of motor oils:

1. The rate of change of viscosity with temperature should be small.
2. The A.S.T.M. pourpoint should be below that temperature at which engine starting will be expected.
3. The oil should deposit a minimum of engine carbon in use.
4. The resistance to sludging should be sufficient to protect the engine against hazards of sludge formation.

Oils excelling in all four of these characteristics provide the motorist with assurance of satisfactory lubrication under all conditions of operation. Moreover, recent researches[1, 2] have shown that the inclusion of the characteristics of small change in viscosity with temperature and high degree of resistance to sludging provide the very advantageous characteristic of low oil consumption.

It was for the purpose of manufacturing such a superior line of oils that this company developed and applied two new processes, one of which is the Chlorex process of solvent extraction. Through its use, oils of high viscosity index† and resistance to sludging are obtained. Operated on distillate oils, it assures a minimum of engine carbon formation[3]; and, in conjunction with propane dewaxing,[4] oils excelling all four important points mentioned above are produced.

The general advantages of Chlorex (β,β'-dichloroethyl ether) as a selective solvent for the production of superquality motor oils from various representative crudes was dealt with in a recent paper[5] presented by J. M. Page, Jr., C. C. Buchler and S. H. Diggs at the spring meeting of the American Chemical Society. The principal purpose of the present paper is to describe the application of this solvent to the commercial production of lubricating oils of high quality.

Selectivity of Chlorex

A brief summary of the information previously published will serve to show the general characteristics of Chlorex which are relative to its suitability as a solvent for production of high grade motor oil. Such a review is given in the following few paragraphs.

From the viewpoint of selectivity, the ideal solvent will separate completely the undesirable, low v.-i., fraction from the desirable, high v.-i., fraction. To do this it must possess high solvent power for the undesirable fraction and dissolve none of the desired fraction at the temperature of extraction.

The vast majority of available solvents fails to attain to these ideals in one of two respects: either, though miscible in all proportions with the undesirable components; or though satisfactorily low in solvent power for the desirable components, they at the same time fail in possessing complete miscibility in all proportions with the undesirables. Solvents of the first type will give good v.-i. raffinates, it is true, but at the expense of loss of good components due to their excessive solubility in the extract phase; solvents of the second type, in general, do not economically attain to the best v.-i. raffinates because of an insufficient degree of difference in partition ratios of the desirable and undesirable fractions between raffinate and extract phases.

TABLE 1—SOLUBILITIES OF 100 AND OF 0 V.-I. OIL IN VARIOUS SOLVENTS
(Solubility in cc. per 100 cc. solvent)

Temp.	100 V.-I. stock			0 V.-I. stock		
(°F.)	Nitrobenzene	Acetone	Chlorex	Nitrobenzene	Acetone	Chlorex
40	13	1.2	1.1	Miscible in all proportions	5.0	Miscible in all proportions
60	19	2.4	2.2	Miscible in all proportions	6.8	Miscible in all proportions
80	25	3.7	3.5	Miscible in all proportions	11.0	Miscible in all proportions

TABLE 2—IMPROVEMENT IN QUALITY OBTAINED BY CHLOREX EXTRACTION OF OILS FROM VARIOUS SOURCES

			Total Chlorex used (Per cent by volume of oil charged)	Before extraction			After extraction		
Sample	Source	Vis. at 210° F.		Vis. index	Sludging time (hours)*	Carbon residue (Conradson)	Vis. index	Sludging time (hours)*	Carbon residue (Conradson)
1	Mid-Continent	50	250	75	21	0.05	96	71	0.02
2	Mid-Continent	50	300	75	20	0.05	102	110	0.03
3	Mid-Continent	90	250	75	37	0.78	85	107	0.21
4	Mid-Continent	90	250	75	37	0.78	90	127	0.21
5	Mid-Continent	183	250	83	64	2.69	92	240	1.19
6	Pennsylvania	50.5	200	103	30	0.17	117	189	0.13
7	California	59	600	54	10	0.64	95	83	0.27
8	West Texas	64	250	64	29	0.03	108	74	0.002

*Indiana oxidation test—70 hours and longer represent such quality as to lead to no serious sludge formation when the oil is used under severe conditions in an engine.

The excellent suitability of Chlorex as a selective solvent when considered according to the above viewpoint, is illustrated in Table 1, in which the solubility of 100 v.-i. (S.A.E. 20) oil and 0 v.-i. (S.A.E. 20) oil in Chlorex is shown. For comparison the solubilities of the same oils in nitrobenzene and in acetone are also shown.

From these data it may be readily seen that Chlorex possesses solvent properties for high and low v.-i. oils which combine the better properties of each of the two major classifications, into which most other solvents in general may be grouped.

Investigation has indicated that Chlorex is suitable to the extraction of all types of stocks. Table 2 gives results of Chlorex extraction of oils from various sources, particularly with reference to possible improvement in quality. Consideration of these results leads to the conclusion that the solvent will produce a substantial improvement over the quality of the oils generally marketed from any given crude source. With reference to Table 2, special mention should perhaps be made to the improvement in resistance to sludging. The data in Table 2 bearing on this point were obtained by the Indiana oxidation test.[1] In this test the oil is retained at 341° F., while air is bubbled through it at a measured rate. Samples of the oil are then removed at frequent intervals, and the per cent asphaltenes formed by the oxidation are determined on these samples. From these data the time required to form 0.1 per cent asphaltenes is determined, and this is called the "sludging time." The sludging time as determined by this test has been correlated with performance of oil in an engine, and it has been found that use of an oil having a sludging time of 70 hours or more will lead to no serious sludge formation in the engine, even under severe conditions.

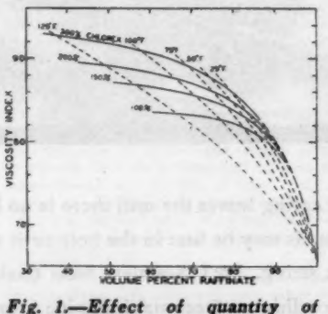

Fig. 1.—Effect of quantity of solvent and temperature of extraction on yield of oil of given viscosity index. Batch extraction

Although plant application of the Chlorex-extraction process for commercial reasons has up to now been limited to distillate stocks, extensive laboratory investigation on residual stocks, covering the range of viscosities from heavy motor oils through bright stocks, has shown beyond question the adaptability of this process to stocks of as widely different properties from Pennsylvania, Mid-Continent and West Texas residuums.

Although Pennsylvania residual stocks have initially a good temperature coefficient of viscosity (high viscosity index), Chlorex extraction noticeably improves even this property. The value of extraction, however, in the case of Pennsylvania stocks lies not in this direction primarily, but rather in the fact that such extraction removes a small quantity of highly undesirable constituents whose deleterious effect on engine performance is shown by the pronounced improvement in the sludging resistance of the finished oil.

Oils having viscosity indices equal to Pennsylvania oil, and extremely stable toward sludging, have been prepared with very good yields from Mid-Continent and Texas residuums by Chlorex extraction, followed by percolation through clay. Thus, counter-current use of about two volumes of Chlorex on these residuums produces oils of 95 to 100 viscosity index which are extremely stable.

The extraction process on residuums may sometimes be combined to advantage with liquid-propane treatment to remove asphalt before or during extraction. This treatment with propane gives better color and/or increased percolation yield on treating with clay to desired color.

Commercial Application

The application of Chlorex to commercial production can be carried out with a minimum of investment. Optimum extraction temperatures are in general not greatly different from the normal atmospheric temperature, so that investment and operating cost for control of extraction temperature is extremely low. Its other properties, also, as shown in Table 3, make it particularly suited to plant use.

TABLE 3—PROPERTIES OF DICHLOBO ETHYL ETHER

Structural formula $Cl\text{-}CH_2\text{-}CH_2\text{-}O\text{-}CH_2\text{-}CH_2\text{-}Cl$	
Boiling point, °F.	352.4
Freezing point, °F.	—61
Specific gravity, 20/20° C.	1.222
Viscosity at 78° F., centipoises	2.06
Viscosity at 77° F., Saybolt Universal	32
Viscosity at 32° F., Saybolt Universal	39
Vapor pressure at 100° F., mm.	10
Latent heat of vaporization, B.t.u. per lb.	115.4
Specific heat at 85° F.	0.369
Flashpoint (closed cup), °F.	168
Solubility in water at 20° C., per cent	1.01
Solubility in water at 90° C., per cent	1.71

The high specific gravity of the solvent makes separation rapid, so that small-sized separating equipment is required. Its low viscosity is also a factor of importance in aiding separation. A small amount dissolved in a viscous-base oil also cuts the viscosity of the latter quite sharply. Its boiling point is well below the initial vaporization temperature of lubricating oils, so that recovery is readily accomplished by distillation. Its low vapor pressure at extraction and storage temperatures contributes to low construction costs and minimizes solvent losses due to evaporation. Its freezing point is so low that precautions in this regard are unnecessary. It is noninflammable at ordinary temperatures; the flashpoint is well above that normally considered hazardous in petroleum refineries. Its solubility in water is sufficiently low to permit distillation with open steam. When the amounts of steam used are large enough to justify it, the dissolved Chlorex substantially can be completely recovered from the water by one of several alternative methods described hereafter.

Chlorex has now been in plant use for over a year and in laboratory use for a much longer period, and in no case has

Chlorex plant at Casper, Wyo.

*Delivered before Chicago meeting of A. P.I., October 25 to 28.

†Viscosity index system of Dean and Davis, Chem. Met. Eng., 36, 618 (1929); see also Davis, Lapeyrouse, and Dean, The Oil and Gas Journal, 30, No. 4, 92 (1932), is used throughout this paper. For simplicity, viscosity index is abbreviated to v.-i. in the following sections.

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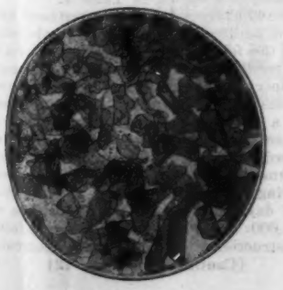

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there been any evidence of sickness or injury due to its use.

Extraction Conditions

The effect of temperature and solvent ratio upon the yield and viscosity index of the raffinate is illustrated in Figure 1, which shows the results of batch extraction of a Mid-Continent distillate (S.A.E. 50). The solid lines represent relationships existing between yield and viscosity index at constant solvent ratio, and the broken lines connect points of constant temperature. In general, the yield of oil of a given viscosity index, and the solvent ratio required to produce it, increases with decreasing temperature.

It follows from the foregoing that the solvent required per volume of finished oil of a given viscosity index on batch extraction is also a function of temperature; this is illustrated in Table 4 showing the relationship for production of an oil of 88 viscosity index (computed from data in Figure 1).

TABLE 4—VOLUMES OF SOLVENT REQUIRED PER VOLUME OF FINISHED OIL

Batch extraction to 88 V.I.
Computed from data in Figure 1

Temperature, °F.	125	100	75	50
Volumes of solvent per volume of raffinate	3.34	3.3	3.64	4.13

The results given in Figure 1 and Table 4 are merely for illustrative purpose to show the general effect of temperature and solvent ratio to show the general effect of temperature and solvent ratio when using the same method of extraction, which in this case is single-batch extraction. The solvent required under these extraction conditions is a maximum. Through the use of a counter-current extraction method the solvent required is substantially less than that shown above. Moreovoer, the amount of solvent required to produce a given result as to viscosity index in a counter-current system decreases as the number of stages increase. This is illustrated in Table 5, where the effect of the use of 2 and 4 stages is shown in comparison with that for batch when making an 88 v.-i. raffinate from a Mid-Continent distillate (S.A.E. 50).

TABLE 5—VOLUMES OF SOLVENT REQUIRED PER VOLUME OF FINISHED OIL—88 V. I.

Batch vs. Counter-current
Temperature, 75° F.

Stages	Batch	2	4
Volumes of solvent per volume of raffinate	3.64	2.8	1.4

Consideration of the above general behavior of Chlorex will show that the process has considerable flexibility, and this gives opportunity to balance first cost and operating cost to fit the possible needs of various refiners.

Description of Plants

Prior to the construction of plants a detailed laboratory investigation of the possibilities of the process was, of course, carried out. This investigation indicated that motor oils far superior to those on the market could be made at a moderate cost. As a result the process was established on a commercial basis, and now has a background of more than a year's commercial operation. Experience has shown that solvent ratios, required yields, and quality of finished oil have all checked very closely with those predicted from laboratory data. Solvent losses have been lower than was assumed when constructing the first plant, averaging about 0.2 per cent per use.

Three plants have been put in commercial operation, charging capacities of these plants being 800, 500 and 100 bbls. per day. They are located at Wood River, Ill., Casper, Wyo., and Tulsa. While they all follow the same general principles, they differ somewhat as to details of the various operations; thus in one plant distillation for solvent recovery is carried out in a pipe still, in a second plant the distillation is carried out in shell stills, while the third employs vacuum supplemented by flashing to atmospheric and stripping with steam. The method of extraction also differs; thus one plant employs a compact continuous counter-current extractor which is being developed to simplify this phase of the operation; a second started operation on a batch-extraction basis, but now employs three continuous counter-current stages of the type customarily proposed for solvent-extraction processes; and a third employs single-batch extraction, although plans are being completed for installation of continuous counter-current stages. Two of the plants handle wax-bearing stock, while the other handles a dewaxed charge. These detailed differences in the three plants were made for the purpose of getting operating information to permit prompt determination of the most satisfactory type of plant for future construction.

TABLE 7—ESTIMATED DAILY REQUIREMENTS—DIRECT
(Charging 50,000 gallons oil daily and 75,000 gallons Chlorex daily)

Item—	Requirements—Plant using pipe still for distillation 2 to 3 men per shift	Plant using batch stills for distillation 2 to 3 men per shift
Labor	2 to 3 men per shift	2 to 3 men per shift
Steam, lb.	50,000	275,000
Fuel oil, gal.	2,200	2,600
Water, gal.	700,000	1,000,000
Power, kwh.	725	250
Solvent loss, gal.	Not more than 150, probably less (see Table 4)	Not more than 150, probably less (see Table 4)

A general flow diagram of the process is shown in Figure 2. Oil is charged from the storage tank A, and is extracted counter-currently with Chlorex from storage tank B; for the purpose of this illustration, three-stage counter-current equipment is shown. The charge oil is mixed with twice-used extract from the separating drum E-2, and the mixture passed through the exchanger C to regulate the temperature for extraction. The mixture is then passed through the mixer D-1 and into separating drum E-1. The extract solution from E-1 passes to the intermediate solution storage tank F. Raffinate solution from E-1 is mixed in D-2 with extract from E-3 and passed to the separator drum E-2. The raffinate solution from this stage is then mixed in D-3, with fresh Chlorex from B and passed into E-3. The raffinate solution from E-3 is then stored in the intermediate storage tank G. The extract and raffinate solutions are charged to their respective stills H and J. The solvent-free oils from these stills are passed to the final extract and raffinate storage tanks O and P. Chlorex and steam are condensed in the condensers K-1 and K-2, and separated from one another in L-1 and L-2—the Chlorex returning to the storage tank B while the water is collected in the intermediate storage tank M, from where it is heated in the still N and about 10 per cent of it evaporated—the dissolved Chlorex being recovered as distillate. The denuded water is discarded to the sewer while the distillate is condensed in K-3 and separated in L-3, the small amount of distillate water being recycled while the Chlorex is returned to B.

With regard to Figure 2 it should be noted that heat exchange can be incorporated in the plant at appropriate points, especially when the method of distillation is continuous.

Common materials of construction are used throughout, and fabrication to stand only moderate pumping pressures is sufficient. Flow controllers on the oil and Chlorex streams to the extraction equipment have been found satisfactory and convenient. Float controls on the separator drums are used, and this method has also been found satisfactory. The mixing of oil and Chlorex in the extraction is done by an open impeller-type mixing pump.

Figure 3 is a photograph of the Chlorex plant at Casper, Wyo., showing Chlorex storage tanks (right rear), building for housing pumping equipment, and (left foreground) solution and finished oil storage.

Solvent Conservation

In any extraction process precautions must be taken to conserve the solvent. A background of experience with the Chlorex process has brought out certain features which are worth noting.

Relatively large plants can operate with the Chlorex process on an astonishingly small solvent storage. The high density of the solvent contributes to rapid separation, which minimizes the amount in process. Continuous methods of distillation, where solutions are heated in tubes, further contribute to low retention. Thus the solvent required to operate a plant processing about 40,000 gallons of oil a day is about 10,000 gallons of solvent. More solvent is, however, frequently a convenience.

The low vapor pressure of Chlorex at the temperature of extraction minimizes the necessity of protection against evaporation. Plant experience in handling this solvent has verified the fact that Chlorex is unusually stable in comparison with other chlorinated compounds. Under normal temperatures no detectable decomposition occurs. Under the elevated temperatures of distillation a minute amount of decomposition occurs; the small amount of acid so formed is neutralized by the introduction of ammonia into the vapor line entering the condenser.

Laboratory investigation has shown that the decomposition of Chlorex is a function of the time and temperature of heating. This factor should be borne in mind when choosing the type of distillation equipment. However, in the plant employing batch distillation under atmospheric pressure and stripping with steam to a final still temperature of 400° F. (representing extreme conditions) the losses in operation have been very small. The losses experienced in operating this plant are shown in Table 6, which gives the record of five months which are typical of the present development of that type of process. It should perhaps be emphasized that losses shown in Table 6 are the summation of losses from all sources, as determined by monthly inventories.

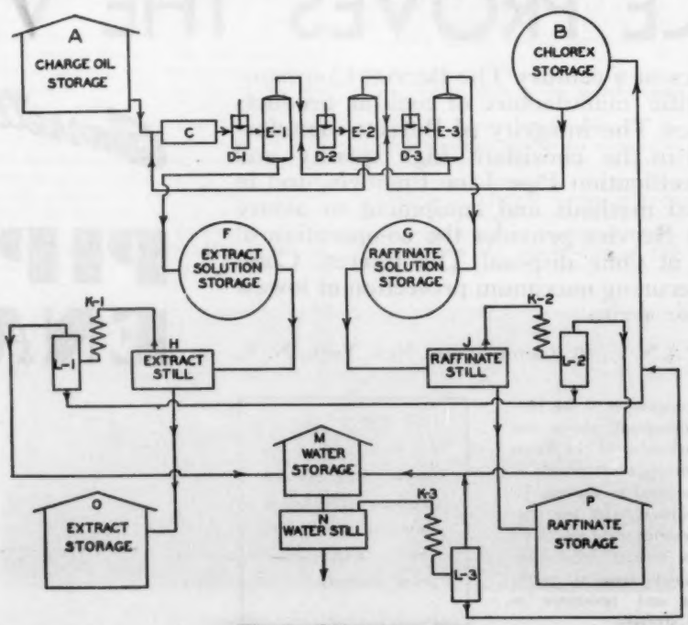

Fig. 2.—Chlorex process

TABLE 6—CHLOREX LOSSES—ALL SOURCES

Month	Chlorex processed (gallons)	Chlorex loss as per cent of Chlorex processed (per cent)
1	1,370,630	0.2571
2	1,703,950	0.1103
3	1,870,000	0.2017
4	1,332,130	0.1833
5	2,268,940	0.1251

As indicated above, there is reason to believe that pipe-still and vacuum-still methods of distillation lead to a substantial reduction in over-all losses; however, the plants employing these methods of distillation have not been in operation long enough to give as certain a statistical monthly loss as that of Table 6.

As stated above, Chlorex dissolved in the water is recovered by distillation of a relatively small amount of the water. Flash distillation is desirable, and at least 90 per cent of the dissolved Chlorex can be recovered in the condensate on evaporation of 10 per cent of the water. Two alternate methods of recovery of Chlorex from water have been proposed and investigated in the laboratory. These are: (1) Injection of the water into the steam line leading to the still and subsequent removal of the so heated water before entering the still; thus the water is heated and denuded, then removed—the Chlorex returning to the still with the steam; and (2) contacting the water with the incoming charge of oil. Both these methods, after laboratory investigation, appear as efficient as the present developed method of recovery by distillation of a portion of the water, and there is reason to believe that they can be developed to improve over the present method.

The oil products from the process are substantially free of chlorides. Quantitative determinations of total chlorides in the reduced oils have been frequently made, and these have shown a chloride content of from 0 to 0.0017 per cent for the raffinate and from 0 to 0.010 per cent for the extract. These traces are wholly removed by the subsequent percolation through clay, and a positive test for chlorides cannot be obtained on the percolated oils.

Operating Costs

Operating costs are perhaps best indicated by tabulation of the requirements of the various items affecting direct costs. For this purpose let us assume operation of a plant such as that shown in Figure 2, charging 50,000 gallons of oil daily and using a solvent ratio of 1.5 volumes of Chlorex per volume of oil. Since a choice of distillation methods exists, it seems desirable to set forth the requirements for alternative methods of distillation. The estimated requirements for such a plant are shown in Table 7.

Fixed charges for plant investment have been omitted from the above tabulation for the following reason: The process is so readily adapted to use of the usual refinery equipment that in many cases plants of large capacity can be obtained at a relatively small out-of-pocket expense through the use of idle or abandoned equipment. Through this latter means two plants have been acquired, having a combined capacity of 1,300 bbls. per day, at an out-of-pocket expense of $35,000 to $40,000 each. This included construction of buildings, contacting

(Continued on Page 72)

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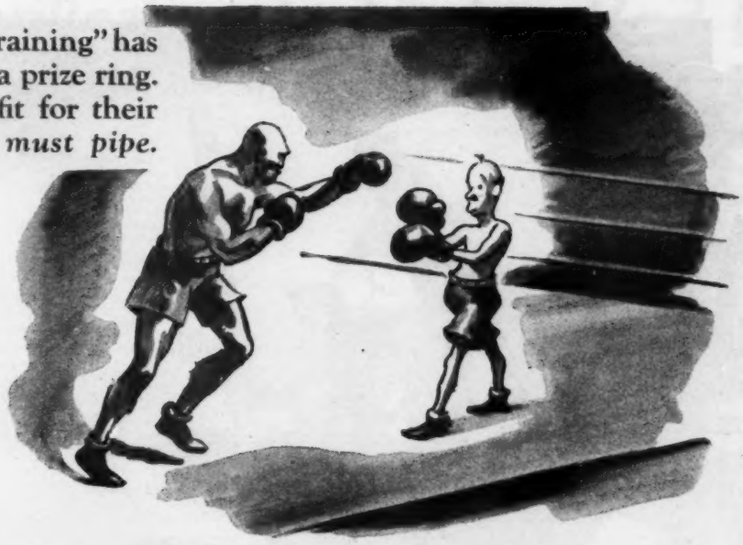

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Explanation of Mechanism of Corrosion Fatigue and Its Application to Sucker Rod Failures

By BLAINE B. WESCOTT[1] and C. NORMAN BOWERS[2*]

The nature and magnitude of the action upon steel of simultaneous corrosion and repetitive stressing was not generally recognized until 1926[3] although attention was called to it as early as 1917.[4] During the past six years the state of knowledge of the phenomenon of corrosion fatigue has been rapidly advanced and its application to the problems of industry has been instrumental in reducing the manufacturing, operating and maintenance costs of numerous commercial enterprises. It is difficult to find an industrial application of steel that entails conditions of corrosion fatigue more generally severe than those under which sucker rods must operate in pumping an oil well. They are subjected to repeated applications of stress, very frequently of high magnitude, while exposed to the corrosive action of concentrated brine often in the presence of gas containing a high percentage of hydrogen sulphide. The action[5] of hydrogen sulphide is not confined solely to increasing the normally damaging corrosivity of oil well waters since it also causes the rapid embrittlement of practically all common steels to a degree dependent upon the conditions of exposure. It is, therefore, evident to those concerned with the task of decreasing the frequency of sucker rod failures that the problem of corrosion fatigue is one of real economic importance in producing operations.

At the present time, sucker rods are regularly fabricated from six different grades of iron and steel; the conditioning treatments are variable.

Other types of alloy irons and steels are in various stages of experimental development, from which it is apparent that there is no unanimity of opinion as to the type of steel best suited for service under the more severely corrosive conditions. It may be of interest, therefore, to consider the nature of corrosion fatigue and its relation to sucker rod failures as well as to call attention to several aspects of the subject to which too little importance has been attached in the previous development particularly with reference to the use of wrought iron.

The Corrosion Fatigue Limit of a Metal

When a metal is subjected to repeated applications or cycles of stress, whatever its nature, the service is considered to be that of fatigue. The fatigue[6] or endurance limit then, is the greatest unit stress that may be indefinitely applied to a metal under any given set of conditions without causing it to fail. The action of cyclic stresses on a metal in the presence of a corrosive medium is termed corrosion fatigue and the corrosion fatigue limit is generally defined as the greatest stress which can be indefinitely applied to the metal without causing its failure under any given set of conditions of stress and corrosion. Thus, the term corrosion fatigue limit has come to be commonly considered as a perfectly definite physical property of a metal. This interpretation is entirely fallacious since it is obvious that the limiting stress required to cause failure is influenced to a large extent by the rate of stress application, i.e., time of exposure to the corrosive medium. It is essential, therefore, that the conditions of test or service be rigidly defined when assigning a value to the corrosion fatigue limit of a metal. It is seldom that conditions of operation can be reproduced with sufficient exactitude so that the corrosion endurance limit determined experimentally may be considered identical to that in service. The application of experimental data to actual operations must be made with care after serious consideration has been given to any existing differences in conditions. The chief value in such data comes from the realization that various types of alloys may be classified relatively in the order in which they may be expected to perform. When used in this manner experimental data are quite reliable and of definite value.

TABLE 1.—STANDARD GRADES OF SUCKER RODS

Number	Type of iron or steel—	Heat treatment
1	Medium carbon steel	end normalized
2	Medium carbon steel	end heat treated
3	Medium carbon steel	fully normalized
4	Medium carbon steel	fully heat treated
5	Low manganese steel (1.25%)	end normalized
6	Low manganese steel (1.25%)	end heat treated
7	Low manganese steel (1.25%)	fully normalized
8	Medium manganese steel (1.75%)	fully normalized
9	Chrome nickel steel	fully heat treated
10	Chrome molybdenum steel	fully heat treated
11	Wrought iron	end normalized

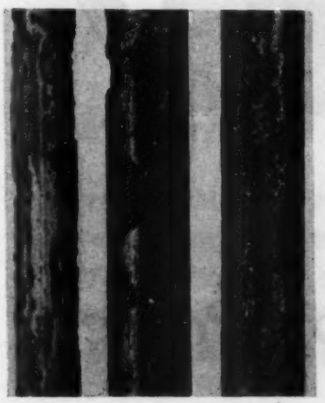

Fig. 1.—Sucker rods, which although severely pitted, are only in the first stage of corrosion fatigue because of the easy pumping conditions

The Mechanism of Corrosion Fatigue

It is probably premature to assume that the theory of the failure of metals by corrosion fatigue is thoroughly understood, but it is of interest to consider the interpretation of the phenomenon which has obtained general acceptance.[7] Failure from this cause occurs in two stages.[8] During the first stage of the action the metal is subjected to damage from the two causes, corrosion and fatigue, to such a degree that failure would eventually result even if all further corrosion were arrested. Because of the electrochemical nature[9] of the corrosion of iron and steel the action generally results in the formation of pits on the surface of the metal. The corrosion of sucker rods proceeds almost without exception by a process of pit formation. This action is illustrated in Figure 1 which pictures several severely pitted sucker rods that were obviously operated under very light pumping conditions. It is well known that the presence of sharp surface discontinuities, such as corrosion pits, results in marked stress concentration, the magnitude of which is controlled by the shape of the irregularities and the nature and physical condition of the metal. When the maximum stress (imposed by the conditions of operation and intensified by stress concentration), reaches a value higher than the endurance limit cracks form at the base of the pits by a process of slippage within the crystals of the metal.[10] The formation of cracks marks the beginning of the second stage of corrosion fatigue which consists of the propagation of these cracks by stress concentration effects of rapidly increasing intensity until the cross-sectional area is reduced to such a degree that rupture follows suddenly. Sucker rods in the second stage of corrosion fatigue are shown in Figure 2.

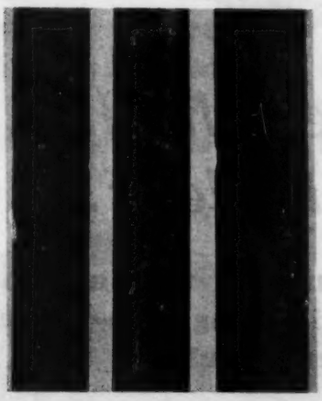

Fig. 2.—Sucker rods showing the corrosion fatigue cracks characteristic of the second stage of corrosion fatigue

When the imposed vibratory stresses of service are high, failure by corrosion fatigue may occur with but relatively little corrosion and little or no formation of cracks at points away from the fracture. An example of such a failure is pictured in Figure 3 where the crack had its inception at the base of a small pit; the characteristic progressive nature of fatigue failure is clearly evident. The smooth appearance of the fractured surface in the vicinity of the pit indicates the relatively slow extension of the crack. As the stress concentration increased the propagation of the crack became more rapid throughout the area with the roughened appearance. Finally, the cross-sectional area was so reduced that the unit stress exceeded the tensile strength of the steel and failure occurred with perceptible deformation. In contrast to the steel sucker rods in Figure 2 are the two wrought iron sucker rods in Figure 4 which, although very deeply pitted, show no evidence of corrosion fatigue cracks. While the absence of these cracks is undoubtedly due in some measure to low imposed stresses it will be shown subsequently that their absence was partly attributable to the low susceptibility of wrought iron to stress concentration.

Localized accelerated corrosion, resulting in rapid corrosion fatigue, is frequently traceable to structural nonuniformity within the metal which causes severe electrochemical action between adjacent sections. The two rods pictured in Figure 5 are examples of this action in which the structural inhomogeneity was brought about by normalizing only the end sections of the sucker rods. The corrosive attack was localized in the zone of transition from that of the hot rolled structure in the body to the normalized structure in the upset end of the rod.

The foregoing examples serve to establish the relationship of corrosion fatigue to sucker rod failures in such a definite manner as to justify the opinion that all failures in the body section of sucker rods which have been operated in wells making water are caused by corrosion fatigue.

Corrosion Fatigue Tests

In this investigation the corrosion fatigue limits of the several metals were determined by the use of modified R. R. Moore rotating beam type fatigue testing machines which are pictured in Figure 6. In this type of machine the specimen is subjected to a constant bending moment between maximum limits in tension and compression. The outer fibers of the metal on the top of the specimen are in compression while those on the bottom are in tension; a half revolution reverses the stress conditions. The action is that of pure flexure and the average stress of a cycle is zero; there is no shear stress.

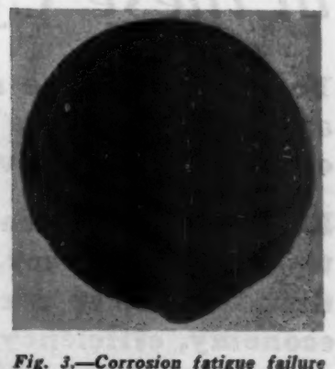

Fig. 3.—Corrosion fatigue failure in a steel sucker rod starting at the base of a small corrosion pit

The modification of the machine was necessitated by the desirability of approximating, as closely as possible, the conditions under which sucker rods operate in pumping a well, i.e., complete immersion of the test specimen in oil well water free from air. The immersion of the specimen was affected by enclosing it in a thin rubber tube fastened at either end to a stuffing box attached to the inner end of the bearing of the machine. Inlet and outlet tubes were connected to passages in the outer case of the stuffing boxes. The water flowed, by a constant gravity head, from the upper reservoir into the bottom of the test chamber at one end and out

---

[1]Before A.P.I., Chicago, Oct. 24.
Author's title, "Corrosion Fatigue and Sucker Rod Failures."
[2]Engineer of Tests, Gulf Research & Development Corp., Pittsburgh, Pa.
[3]Materials Engineering Division, Gulf Research & Development Corp., Pittsburgh, Pa.
[3]Stress-Strain Cycle Relationship and Corrosion Fatigue of Metals. D. J. McAdam, Jr.; Proc. Amer. Soc. Test. Mat., 1926, 26, (2), 224.
[4]Experiments on the Fatigue of Brasses. H. F. Haigh, J. Inst. Metals, 1917, 18, 55.
[5]Effect of Hydrogen Sulphide on Wire Rope. B. B. Wescott and L. W. Vellmer; Trans. Am. Soc. Mech. Eng., 52, 7, 59.
[6]The Fatigue of Metals. Moore and Kommers.
[7]Corrosion Fatigue of Metals. H. J. Gough; Jour. Inst. Metals, 49, (2), 1932. (A complete discussion of corrosion fatigue.)
[8]Fatigue and Corrosion Fatigue of Metals. D. J. McAdam, Jr.; Proc. Internat. Cong. Test. Mat., 1927.
[9]Influence of Rust upon the Corrosion of Iron and Steel. J. Aston; Trans. Amer. Electrochem. Soc., 29, 449, 1916.
[10]The Fatigue of Metals. H. J. Gough.

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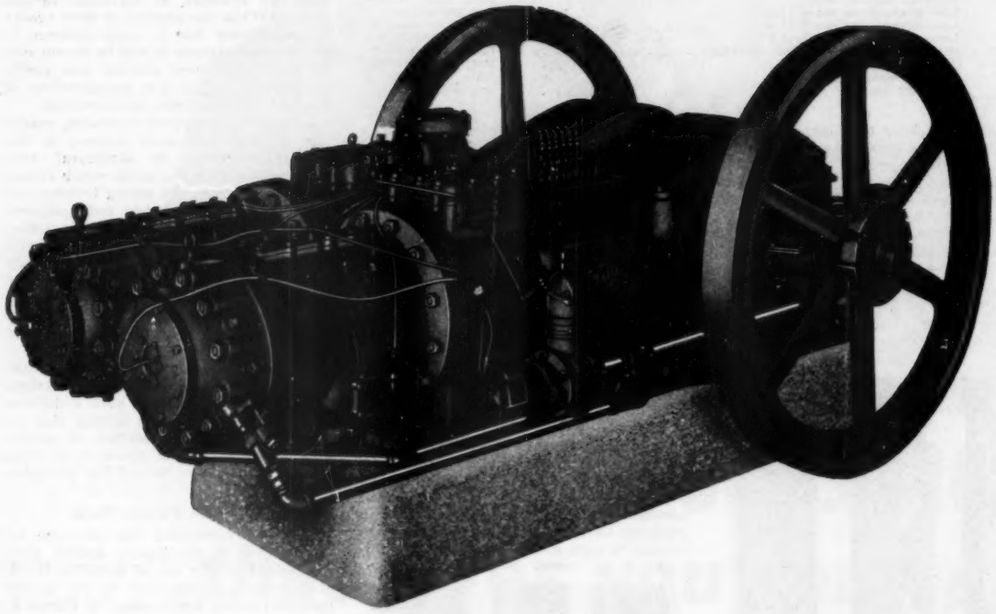

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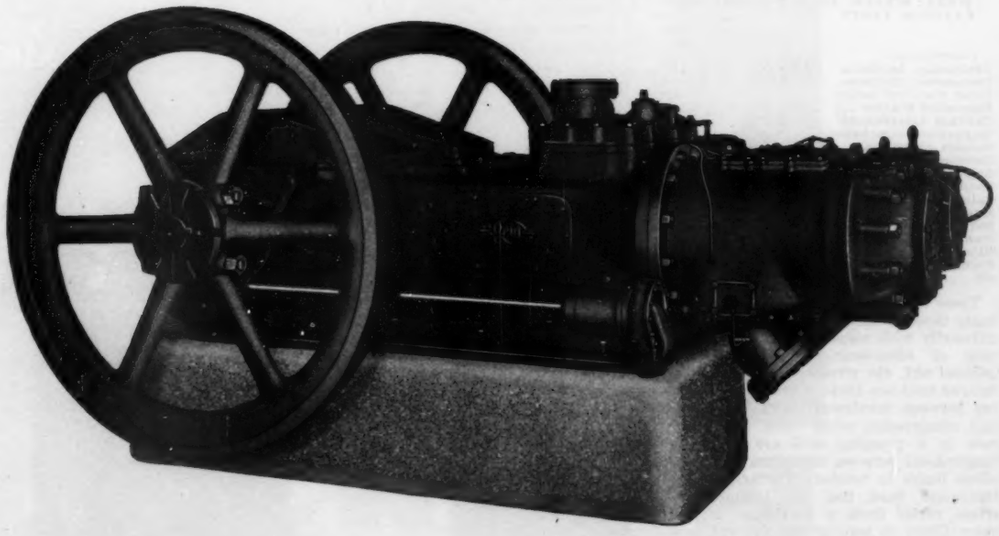

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of the top at the opposite end into a lower receiving reservoir. From here it was returned to the upper reservoir for recycling by a natural gas lift. A positive pressure of natural gas was maintained throughout the apparatus in order to exclude air. All parts of the water circulating systems were constructed either of glass or rubber except the stuffing boxes which were coated with lacquer to prevent electrolytic action with the specimen.

The corrosion fatigue limit was taken as the maximum unit stress that did not cause failure in 10 million stress reversals at a frequency of 1,750 applications per minute and a temperature of 125° F. The water used was a corrosive non-sulphide water from the Smackover Field

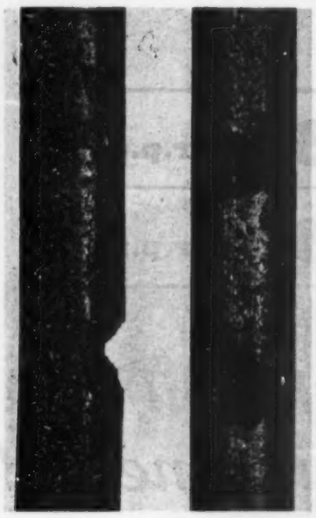

Fig. 4.—Exceptionally deep corrosion pits in wrought iron sucker rods which did not cause the formation of corrosion fatigue cracks

having the composition given in Table 2. In the determination of the endurance limits under conditions of sulphide corrosion fatigue the circulating water was kept saturated with hydrogen sulphide by the continuous bubbling of the gas through the water in the upper reservoir.

TABLE 2—COMPOSITION OF SMACKOVER WELL WATER USED IN CORROSION FATIGUE TESTS

Constituent—	Calculated as	Parts per million
Temporary hardness	$CaCO_3$	23.0
Permanent hardness	$CaCO_3$	3,517.0
Total dissolved solids		71,694.0
Suspended matter		3.0
Calcium bicarbonate	$CaCO_3$	23.0
Magnesium bicarbonate	$MgCO_3$	nil
Sodium bicarbonate	$NaHCO_3$	nil
Calcium sulphate	$CaSO_4$	19.0
Magnesium sulphate	$MgSO_4$	nil
Sodium sulphate	Na_2SO_4	nil
Calcium chloride	$CaCl_2$	2,710.0
Magnesium chloride	$NgCl_2$	983.0
Sodium chloride	NaCl	67,940.0
Iron and alumina	R_2O_3	8.0
Silica	SiO_2	6.0
Permanganate consumed	$KMnO_4$	6.0
pH		7.6

These conditions of test do not approximate those of service in several respects, primarily with respect to the nature and rate of consideration. As previously pointed out, the stresses imposed by the fatigue tests are those of transverse bending between maximum limits in tension and compression while those on sucker rods in a pumping well are primarily longitudinal between maximum and minimum limits in tension. Further, in the transverse bend test the intensity of stress varies from a maximum at the outer fibers to zero at the neutral axis while the longitudinal stressing imposes uniform distribution of load over the entire cross-sectional area. The relationship[11] between the fatigue limits of several materials under conditions of transverse and longitudinal direction of loading is given in Table 3. From these data it seems evident that the endurance limit of iron or steel under axial loading averages approximately 86 per cent of the endurance limit under transverse bending. Since there is a constant relation between the two values it may be concluded that the rotating beam test affords a reliable method for the determination of fatigue and corrosion fatigue limits of sucker rod materials.

In order that rotating beam test data may be converted to values more nearly representative of what may be expected when the materials are stressed as in sucker rod service it only remains to establish the relationship between the fatigue limits under complete reversals of stress and under maximum and minimum limits in tension, respectively. This has been determined[6] experimentally and may be expressed quantitatively by the following equation:

$$S_{max.} = \frac{1.5\,S_{-1}}{1.0 - 0.5r} \text{ or } \frac{S_{max.}}{S_{-1}} = \frac{3}{2 - r} \quad (1)$$

where:

$S_{max.}$ = maximum unit stress during a cycle.

S_{-1} = fatigue limit for complete reversal of stress.

r = range ratio for the cycle (the algebraic ratio of minimum stress to maximum stress)

It has been found that this equation fits the available data with reasonable exactitude and where it differs from such data it is usually on the side of safety. It will be noted from the above expression that the fatigue limit is higher when the stress limits have a positive value

TABLE 3—ENDURANCE LIMITS OF IRONS AND STEELS UNDER TRANSVERSE AND LONGITUDINAL LOADING

Material—	Carbon (%)	Heat treatment*	Endurance limit—(lb./sq. in.)—Transverse†	Endurance limit—(lb./sq. in.)—Axial‡	Ratio of axial to transverse
Ingot iron	0.03	hot rolled	27,000	26,000	0.96
Wrought iron, single refined	...	hot rolled	26,500	24,000	0.91
Wrought iron, double refined	...	hot rolled	28,000	24,000	0.86
Wrought iron, mechanical	...	hot rolled	31,000	24,000	0.77
Carbon steel	0.45	N1610°, A1470°	35,800	26,500	0.74
Carbon steel	0.45	N1610°, A1470°, OQ1525°, T1105°	46,300	45,800	0.99
Carbon steel	0.47	N1615°, A1475°	38,500	31,000	0.80
Carbon steel	0.47	N1615°, A1475°, OQ1525°, T1000°	58,400	49,500	0.85
Carbon steel	0.87	N1490°, A1400°	40,000	30,000	0.75
Carbon steel	0.87	N1490°, A1400°, OQ1480°, T1000°	59,800	59,000	0.99
Rail steel	0.66	hot rolled	69,600	57,500	0.82
Rail steel	0.70	hot rolled	55,000	44,500	0.81
Rail steel	0.75	hot rolled	44,200	41,500	0.94
Rail steel	0.82	hot rolled	55,300	47,000	0.82

*N = normalized, A = annealed, OQ = oil quenched, T = tempered.
†Determined with R. R. Moore rotating beam type fatigue testing machine.
‡Determined with Haigh axial loading type fatigue testing machine.

TABLE 4—CHEMICAL COMPOSITION OF LOW MANGANESE STEEL, WROUGHT IRON AND NICKEL WROUGHT IRON

Constituent—	Per cent—1.25% manganese steel	Per cent—Wrought iron	Per cent—Nickel wrought iron
Carbon	0.360	0.030	0.040
Manganese	1.170	0.040	0.030
Phosphorous	0.024	0.033	0.052
Sulphur	0.021	0.012	0.024
Silicon	0.190	0.160	0.110
Slag	....	4.200	2.920
Nickel	....	....	3.420

TABLE 5—PHYSICAL PROPERTIES OF LOW MANGANESE STEEL, WROUGHT IRON AND NCKEL WROUGHT IRON

Property—	Result—1.25% manganese steel	Result—Wrought iron	Result—Nickel wrought iron
Yield point (lb./sq. in.)	71,300	42,100	51,700
Tensile strength (lb./sq. in.)	100,000	47,700	62,500
Elongation (% in 2 in.)	22.8	32.6	31.0
Reduction in area (%)	63.9	46.4	48.1
Impact resistance (Charpy, ft. lb.)	34.6	19.9	22.1
Hardness (Brinell)	206	74	150
Condition	hot rolled	hot rolled	normalized at 1600° F.

TABLE 6—FATIGUE PROPERTIES OF LOW MANGANESE STEEL, WROUGHT IRON AND NICKEL WROUGHT IRON

Conditions of test—	Fatigue limit (lb./sq. in.)—1.25% manganese steel	Fatigue limit (lb./sq. in.)—Wrought iron	Fatigue limit (lb./sq. in.)—Nickel wrought iron	Ratio of fatigue limit to tensile strength—1.25% manganese steel	Ratio of fatigue limit to tensile strength—Wrought iron	Ratio of fatigue limit to tensile strength—Nickel wrought iron
Noncorrosive (ordinary fatigue limit)	45,900	30,400	40,100	0.49	0.64	0.64
In oil well water saturated with natural gas and free from air	19,600	19,600	25,600	0.20	0.41	0.41
In oil well water saturated with natural gas and hydrogen sulphide and free from air	14,600	16,400	14,900	0.15	0.34	0.24

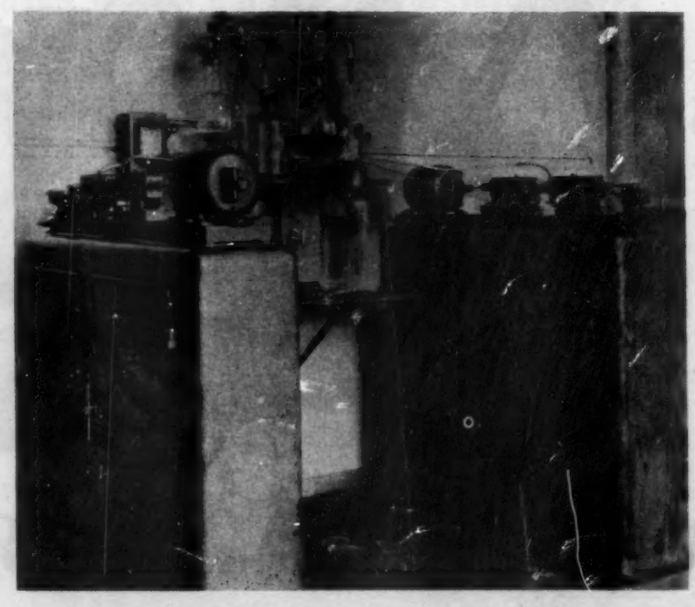

Fig. 6.—Modified R. R. Moore rotating beam type fatigue testing machines for the determination of corrosion fatigue limits of metals

Fig. 5.—Localized accelerated corrosion caused by structural nonuniformity of the steel

than it is when the stresses are reversed and that the fatigue limit varies inversely with the range of the stress.

The remaining important difference between test and operating conditions is the rate of stress application, i.e., the time factor. Rate of stress application,[6] even within wide limits of variation, has no effect on the fatigue limit of iron and steel when there is no accompanying corrosive attack. This is not the case, however, when the action is that of combined stressing and corrosion. It has been shown[12] that at a constant range of stress the number of cycles to failure decreases and the time increases with decrease in cyclic frequency. It follows then, that when the stresses are low in magnitude and the rate of stressing slow, severe damage may occur from corrosion before there is visible evidence of corrosion fatigue. There is no reason to suppose that the various ferrous materials will react differently to changes in the rate of cyclic stressing especially since it appears that the extent of damage from corrosion fatigue is controlled principally by the corrosion resistance of the metal. Therefore, while corrosion fatigue tests may not always faithfully reproduce all the conditions of service, intelligent interpretation of results from carefully conducted investigations will classify metals in their proper order of serviceability.

Experimental Data

From a large number of alloys which have been tested three were selected for consideration: a low manganese steel

[11]Endurance Testing of Steel: Comparison of Results Obtained With Rotating-Beam versus Axially-Loaded Specimens. R. D. Prance; Proc. Amer. Soc. Test. Mat., 31, (2), 176, 1931.

[12]Influence of Corrosion Accelerators and Inhibitors on Fatigue of Ferrous Metals. F. N. Speller, I. B. McCorkle and P. F. Mumma; Proc. Amer. Soc. Test. Mat., 28, (2), 159, 1928.

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which is representative of the present steel sucker rods, wrought iron and nickel wrought iron which are representative of the latest adaptation of new materials to sucker rods. The successful application of the two latter materials to the severe operating conditions in the sulphide fields of West Texas and Kansas made their inclusion particularly pertinent. The chemical compositions of the materials are given in Table 4 and the static physical properties in Table 5. The low manganese steel was made by the electric furnace process, the wrought iron was hand puddled and double refined and the nickel wrought iron[13] was made by the Aston mechanical puddling process which can be used for manufacturing alloy wrought irons that are virtually

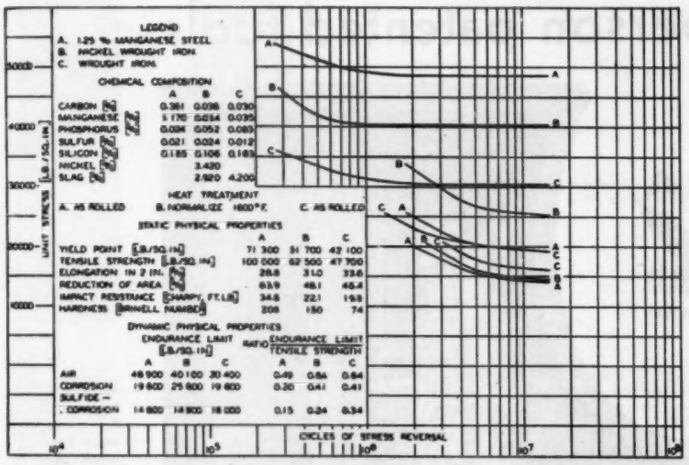

Fig. 7.—Fatigue and corrosion fatigue properties of low maganese steel, wrought iron, and nickel wrought iron

nonproducible by the hand puddling process. Of interest in the tabulation of the static physical properties, because of their bearing on the subsequent discussion, are the greater elastic and ultimate tensile strength of the steel and the strengthening and hardening effect of the nickel on the ferrite which is the principal constituent of wrought iron.

The fatigue properties under noncorrosive and corrosive conditions of test are given in Table 6. Significant points in Table 6 are: the superiority of the steel in noncorrosive fatigue, the high ratio of fatigue limit to tensile strength of the two wrought irons and the relatively severe damage to the steel from corrosion fatigue. Although ratios of corrosion fatigue limit to tensile strength are recorded it is not intended to indicate that any constant relationship exists between these values. The ratios provide a convenient method for indicating relative damage from corrosion fatigue. No reason can be advanced to explain the unusually high ratio of sulphide corrosion fatigue limit to tensile strength of the wright iron, but this fact undoubtedly accounts in part for the excellent performance of those rods in sulphide fields.

The stress-endurance curves (so-called S-N curves) plotted from the fatigue test data are given in Figure 7. Attention is called to the fact that, under the conditions of testing defined, the corrosion fatigue curves do not become truly horizontal after only 10 million reversals of stress. It is not unreasonable to assume that if the tests were sufficiently prolonged that the corrosion endurance limit would approach zero because of the total destruction of the metal by corrosion.

Significance of Fatigue Test Data

Consideration of the data in Table 6 would naturally lead to the conclusion that but little improvement in service in sulphide fields could be expected by the substitution of wrought iron for the low manganese steel. Although no authoritative records can be quoted, it is reliably reported that great improvement has been obtained from the replacement of steel rods by wrought iron rods. An analogous situation exists in other applications of the two metals to fatigue service and the proponents of wrought iron have consistently maintained that the metal possesses an inherent property which renders it particularly resistant to fatigue action. Up to the present time, however, no fatigue test has been devised which demonstrates any such peculiar property of the metal. The wrought iron industry has attempted to explain this reputed ability by the opposition offered to the propagation of crystal slippage and incipient fatigue cracks by the slag inclusions which are the cause of the characteristic fibrous nature of wrought iron. This theory, however, appears to be totally inadequate as shown by coisideration of the following points: First, wrought iron in a heterogeneous material composed of ductile ferrite, the continuity of which is broken up by innumerable particles of brittle slag having but little tensile strength or adherence to the matrix ferrite; second, it is clearly evident (Table 5) that the slag in wrought iron decreases the ductility of the metal in static physical tests and there is no reason for supposing that this action would be reversed under conditions of cyclic stressing; third, it is logical to believe that the slag particles would normally function as stress raisers rather than as stress distributors; and finally, segregation of a constituent at the grain boundaries as slag occurs in wrought iron is generally detrimental to the physical properties of a metal. It seems necessary to develop some other theory to account for the instances where wrought iron has given unusual service and for this reason it is important to consider the action of fatigue in somewhat greater detail than heretofore.

Relative Susceptibilities of Brittle and Ductile Materials to Stress Concentration

It has been stated[7] that the resistance of a metal to corrosion fatigue is almost wholly determined by its corrosion resistance. From figure 4 it is evident that wrought iron sucker rods cannot be considered corrosion resistant and since it has further been established that there is no apparent advantage for wrought iron over steel in short time corrosion fatigue tests, it follows that the explanation must be found in the respective reactions of the two materials to stress concentration at the base of corrosion pits under the action of alternating and steady axial stresses between limiting values in tension.

From experimental data[14] it has been determined that the profile of a fatigue limit graph for steady and alternating stresses of varying relative magnitudes is given by the following empirical equation:

$$a = a_o\left[1 - \left(\frac{s}{u}\right)^n\right] \qquad (2)$$

where:

- a = fatigue limit under varying conditions of alternating and steady stresses.
- a_o = the ordinary fatigue limit found when there is no steady stress.
- u = ultimate tensile strength.
- s = steady stress at any time.
- n = index characteristic of the metal (the value is usually between 1 and 2).

The value of n for a mild steel having a yield point of 42,000 lb./sq. in. and tensile strength of 60,000 lb./sq. in. was found to be 2 while for a heat treated steel having a yield point of 100,000 lb./sq. in. and tensile strength of 120,000 lb./sq. in. n was found to have a value of 1. From these values it is possible to calculate n for any steel having physical properties within the above limits from the equation:

$$n = 2.864 - \frac{(y + t)}{118{,}000} \qquad (3)$$

where:

- y = yield point in lb./sq. in.
- t = tensile strength in lb./sq. in.

By substitution of the proper values from Table 5 in Equation 3 the values of n for the three materials were calculated. Substituting those values, together with the respective corrosion fatigue limits from Table 6, in Equation 2 made possible the plotting, in Figure 8, of the fatigue profile curves (full lines A, B and C) for different values of steady and alternating stresses. The dotted lines

[13]Material provided through the courtesy of the A. M. Byers Co., Pittsburgh, Pa.

[14]The Relative Safeties of Mild and High Tensile Alloyed Steels Under Alternating and Pulsating Stresses. B. P. Haigh; Chem. and Ind., 22, Jan. 11, 1929.

line of the particular material in question.

The relative effects of stress concentration resulting from corrosion pits can be determined for the three alloys from Figure 8 so that the probable relative services to be expected from them, when used for sucker rods, can be predicted for any pumping conditions. The example following will make clear how relative service may be predicted. The pumping conditions, which are those of a well in West Texas where wrought iron rods were used, are:

- s (steady stress or dead load) = 23,000 lb./sq. in.
- a (alternating stress or impulse load) = 6,400 lb./sq. in.

It is necessary to assume a stress concentration factor from corrosion pits which, in this case, will be taken as two for all three materials (the actual value is immaterial, but is probably close to the assumed value). This is clearly unfair to the wrought iron since it is known that the notch sensitivity (susceptibility to stress concentration) of dead soft iron or steel is less than that of harder steels. However, no allowance for this difference will be made.

The point P (Figure 8) represents the stress conditions defined above where no stress intensification exists. At the base of a corrosion pit where the stress concentration factor has been assumed to be two, the stresses are:

- s = 46,000 lb./sq. in.
- a = 12,800 lb./sq. in.

as represented by the point Q. It is seen from Figure 8 that Q lies on the fatigue profile curve (full line A) for the low manganese steel, thereby indicating that

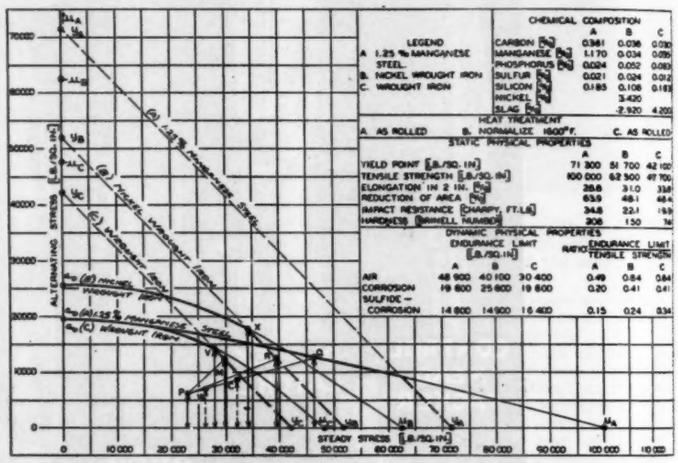

Fig. 8.—Effect on fatigue limit of varying the relation between steady and alternating stresses

A, B and C (yy) connect the yield points respectively of the three materials on the two ordinates of the graph and are expressed by the equation:

$$(s + a) = y \qquad (4)$$

where:

- y = yield point.
- s = steady stress.
- a = alternating stress.

The truth of the relationship in Equation 4 is evident since, if the sum of the steady and alternating stresses (s + a) becomes equivalent to the field point (y), the metal will yield in a plastic manner without fatigue.

The area below the fatigue profile curve (full lines A, B and C) represents combinations of steady and alternating stresses that will not cause fatigue failure of the material while the area below the yield lines (dotted lines A, B and C) represents combinations of steady and alternating stresses that will not cause failure by plastic yield. The safe combinations of stresses that will not cause failure either by fatigue or plastic yield lie in the area bounded above by the fatigue line and on the right by the yield

under these conditions the steel rods will eventually fail from corrosion fatigue.

In considering the action of these stresses on the nickel wrought iron it is found that the sum of the steady (s) and alternating (a) stresses is 58,800 lb./sq. in., a value in excess of the yield strength (51,700 lb./sq. in.) of the material. From this it follows that the material must yield locally in a plastic manner at the base of the corrosion pit, thereby effecting a redistribution of load over the section where there is a concentration of stress. Since the magnitude of the alternating stress is fixed by the pumping conditions of the well (length and speed of stroke and depth to fluid) the steady stress (s) at the base of the pit never reaches a value in excess of:

$$s = y - a = 51{,}700 - 12{,}000 = 38{,}900 \text{ lb./sq. in.}$$

so that the residual combination of stresses at the pit is s = 38,900 lb./sq. in. and a = 12,800 lb./sq. in. represented by the point R. This point, however, lies below the fatigue profile curve (full line B) for the nickel wrought iron, indicating that there will be no failure from corro-

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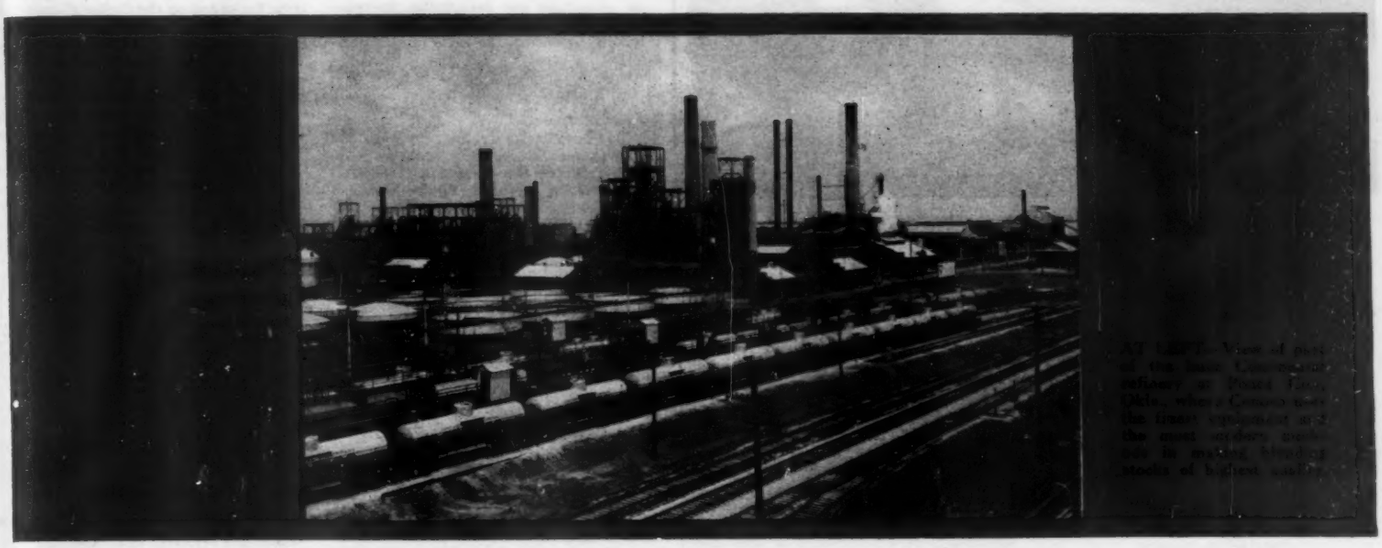

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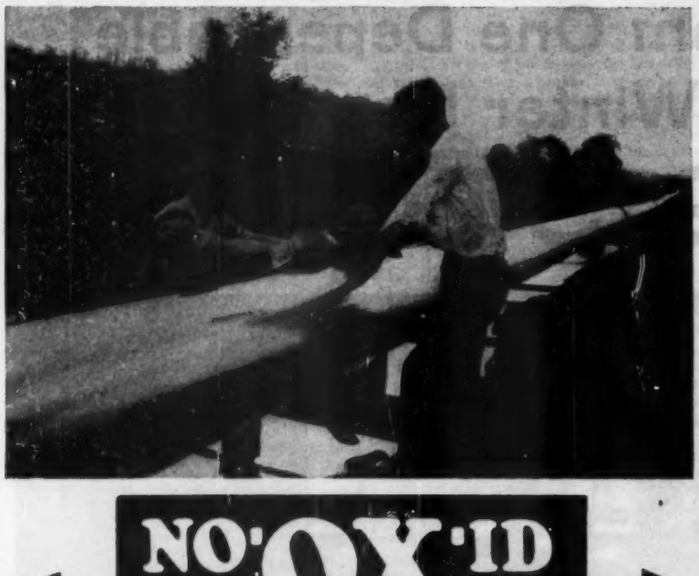

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sion fatigue. In reality, before failure would be expected, the nominal stresses could be increased (by increasing speed or length of stroke) until the local stresses reach, $s = 34{,}000$ lb./sq. in. and $a = 18{,}000$ lb./sq. in. as represented by the point X at the intersection of the fatigue profile curve with the yield point line. The value to which the nominal stresses could be increased without causing failure by corrosion fatigue can be calculated from the above value of alternating stress ($a = 18{,}000$ lb./sq. in) using the equation:

$$a' = (a + 2)c \qquad (5)$$

where:

a = nominal alternating stress.
a' = local intensified alternating stress.
c = stress concentration factor.
s = permissible increase in alternating stress.

In this case the permissible increase amounts to 2,600 lb./sq. in. Since, as originally specified, the ratio of steady to alternating stress is 3.6, the permissible increase in the steady stress is 9,360 lb./sq. in. Thus, the combination of nominal stresses which must be reached before there can be failure by corrosion fatigue is:

$s = 32{,}200$ lb./sq. in. and $a = 9{,}000$ lb./sq. in. (point C, Figure 8).

In a similar manner it can be shown from Figure 8 that the concentrated stresses at a corrosion pit in a wrought iron sucker rod under identical operating conditions would have the values $s = 29{,}300$ lb./sq. in. and $a = 12{,}800$ lb./sq. in. (point M). The localized stresses may be increased to $s = 28{,}000$ lb./sq. in. and $a = 14{,}500$ lb./sq. in. (point V) corresponding to nominal stresses of $s = 26{,}100$ lb./sq. in. and $a = 7{,}300$ lb./sq. in. (point W) before danger of corrosion fatigue failure.

According to this theory, for the conditions of stress and stress concentration as defined, the nickel wrought iron is 41 per cent stronger than the low manganese steel although the latter is 38 per cent stronger at the yield point, 60 per cent stronger at the ultimate tensile strength and 22 per cent stronger at the ordinary fatigue limit. Likewise, the wrought iron is 13 per cent stronger than the low manganese steel, which is 69 per cent stronger at the yield point, 110 per cent stronger in ultimate tensile strength and 28 per cent stronger at the ordinary fatigue limit. These advantages may be actually much greater for the two wrought irons since it is possible that the presence of innumerable particles of incorporated slag, which of a certainty must function as stress concentrators, renders this type of material practically insensitive to any further appreciable stress concentration arising from surface discontinuities.

Summary

In the foregoing discussion it has been shown that a very large proportion of sucker rod failures is caused by corrosion fatigue, and the mechanism of failure by this action was explained according to the theory which is most generally accepted at the present time. Attention was called to the differences between the conditions of test and service and to the necessity for taking account of them when applying experimentally determined data to field operations. An explanation was advanced to account for the unusual resistance of wrought iron sucker rods to corrosion fatigue which has been indicated, if not yet definitely established, by limited field tests. Space did not permit amplification of the discussion to include the effects in ordinary fatigue of stress concentration such as is caused by threads, keyways, sharp fillets, abrupt changes of section, etc., but the theory should apply equally well to these cases.

It is suggested that additional information of interest and possibly better service might result from field tests of sucker rods fabricated from low carbon alloy steels and alloy irons, particularly the nickel carburising steel (S.A.E. 4615), steel containing approximately 0.12 per cent carbon and 1.25 per cent manganese, low carbon nickel manganese steels and ingot iron containing up to 3.50 per cent of nickel.

Acknowledgments

The authors are indebted to Dr. Paul D. Foote, executive vice president of the Gulf Research & Development Corp., for permission to publish this article and to E. N. Kemler of the engineering division of the Gulf Research & Development Corp. and the University of Pittsburgh for suggestions in the preparation of the manuscript.

Commercial Application of the Chlorex Process

(Continued from Page 62)

equipment-control instruments and some tankage. Principal items of old equipment used included some tankage and distillation equipment.

It should also be noted that no royalty is to be added to the items of cost tabulated above because, according to the present arrangement with the manufacturer of Chlorex,‡ this item is included in the solvent cost.

The authors wish to acknowledge the co-operation of the Carbide & Carbon Chemicals Corp. in developing a liscensing arrangement, and of the Mid-Continent Petroleum Corp. in supplying some of the information contained herein.

‡Carbide & Carbon Chemicals Corp.

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San Antonio Geologists Announce Their Program

SAN ANTONIO, Tex., Oct. 23.—The program of the San Antonio section, American Association of Petroleum Geologists, annual convention and field meet, released today, provides for a field trip starting from Victoria at 11 a.m. Friday, October 27, studying the Lissie and Beaumont formations and Raisin, Greta, Fox, Refugio, and Saxet Fields and Bonnieview area en route to Corpus Christi, with a barbecue dinner at the McFadden ranch.

The convention opens at 8:15 in the Plaza Hotel, Corpus Christi, Saturday, October 28, with an address by Dr. R. T. Hill, followed by papers on "Surface Geology of Jackson, Catahoula, and Lower Oakville from Grimes County to Gonzales County," by B. Coleman Ranick of San Antonio; "The McFaddin-O'Connor, Greta, Fox, Refugio, White Point and Saxet Fields," by A. E. Getzendaner of Corpus Christi; "Comparison of the Structural Conditions of Conroe, Tomball, and Pettus Oil Fields," by L. P. Teas of Houston; "Present Efforts in Geophysical Surveying," by Paul Weaver of Houston; "Tectonic History of Balcones System," by Charles Laurence Baker of Austin; "Preliminary Interpretation of the Late Tertiary and Quartenary History of South Texas," by Ed W. Owen of San Antonio; "Mount Selman Formation of Frio County," by L. W. Clark and L. W. MacNaughton; "Stratigraphy of Starr County and Southern Zapata County," by Earle R. Wall of McAllen, Tex.

On Sunday, October 29, a field trip from Casa Blanca to George West to study the outcrop of Goliad and Lagarto formations.

TAX EVASION COSTS HEAVILY

Governor Johnson of Colorado is quoted in press dispatches as saying his State has been losing hundreds of thousands of dollars through gas tax evasion. State Treasurer Bedford added that such tax evasion and smuggling of gasoline are among the worst rackets with which the State has to contend.

Effect of Organic Coatings in Preventing Damage to Metal Subjected to Stress and Corrosion

By F. N. SPELLER and I. B. McCORKLE*

It has been known for some time that metals when repeatedly loaded will fail at stresses below their tensile strength. However, there is a limiting value below which the metal may be repeatedly stressed indefinitely without injury. This is called the "fatigue" or "endurance limit." For ferrous materials the endurance limit, when the stresses are completely reversed, averages about 45 per cent of the tensile strength. This average is subject to wide variation. Results as low as 30 per cent and as high as 73 per cent have been observed.

When even a small amount of corrosion is present with cyclic stress the "endurance limit" may be reduced considerably. The combined action of stress and corrosion is termed "corrosion-fatigue." The amount of cyclic stress that a metal will stand under these conditions depends upon the character of the

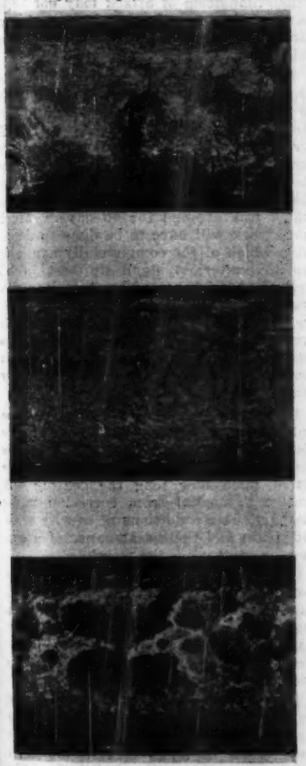

Fig. 1.—Typical corrosion fatigue tests in sucker rods

corrosion and the nature of the protective films that are formed by the metal or its environment. Therefore, it is hard to conceive of a fixed corrosion-fatigue limit for any metal under all conditions of exposure. Corrosion factors predominate in corrosion-fatigue so that if there is what might be termed a corrosion-fatigue limit it is independent of the tensile strength. Heat treatment of steel raises the tensile strength and the air-endurance limit, but if it does not increase resistance to corrosion it will have no material influence on the resistance to corrosion-fatigue. Even corrosion-resistant alloy steels high in chromium show a considerable reduction in their endurance properties in corrosive environment, but not to the same degree as carbon or low alloy steel.

In the oil industry considerable loss is caused by corrosion-fatigue. For example, zur Horst and Wescott[1] in discussing several thousand failures of sucker rods in a selected group of the heavier pumping wells in Texas and Louisiana expressed the opinion that practically all of the body failures were due to corrosion-fatigue. The writers have had occasion to examine failure of drill pipe and other tubular products which show certain characteristics[2] pointing unmistakably to corrosion-fatigue as the dominant cause of failure in service.

*Before A.P.I., Chicago, October, 1933.

Air-Fatigue Limit

The actual amount of corrosion that will cause a relatively great reduction in the air-fatigue limit of a metal is unbelievably small and many times it would be difficult to measure except by its effect on the endurance limit in air. It has been shown recently by Gough and Sopwith[3] that even the slight corrosion that occurs in air produces a lower fatigue value than when the metal is stressed in an inert environment. It has also been shown[4] that the air endurance limit is at least maintained, if not slightly raised, by the invisible passivating film that is formed on the steel when a small amount of sodium dichromate is added to the water. These passive films, however, can be maintained on ordinary steel only when it is continuously in contact with an oxidizing solution such as sodium chromate or dichromate. In such environment the film is quickly repaired when injured, but unfortunately it is not practical to control the environment as a rule. It has also been shown[4, 5] that the damage to a given material due to corrosion-fatigue can be lessened by partial protection against corrosion where the line of contact between coating and metal is approximately parallel to the most strained section.

From this experience it seems possible that the damage due to corrosion-fatigue may be economically reduced or the permissible working stress increased by using either a metal less susceptible to corrosion that has the power to build up a natural selfprotecting film, or by applying an artificial protective coating that will resist the combined action of stress and corrosion.

Broadly speaking, no commercial metal is entirely noncorrodible or equally resistant to all environment, and no nonmetallic coating is insoluble or impervious to moisture. Therefore, complete protection against corrosion-fatigue is not in sight, but it is reasonable to expect that partial economic protection under some conditions may be obtained. More or less protection may be obtained by the use of a less corrodible metal,[6, 7] by metallic protective coatings,[6, 7, 8] or by nonmetallic protective coatings, such as vitreous enamel or "paints."

Paint Coatings

Of the various methods which might be employed, the use of paint coatings is an attractive possibility on account of their relatively low cost and ease of application and repair. It is this phase of the subject that is discussed in this paper. Only the preliminary portion of the investigation outlined on this subject by the committee has been completed, but from the laboratory results already obtained and some experience in the field, it appears that under certain conditions suitable paint coatings will give sufficient increased life to the metal to warrant their application. The development in the technology and manufacture of paints and varnishes during the past few years now affords a wide choice of materials. As yet few tests to destruction have been made on paint coatings in water solutions so that a considerable amount of static experimenting will have to be done before the best of the available materials can be selected for test under stress in corrosive environment. This method of testing is desirable to minimize the time-consuming and expensive corrosion-fatigue work.

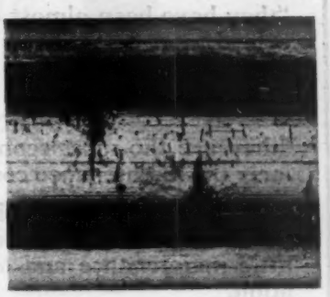

Fig. 2.—Inside appearance of superheated tube which failed, due to corrosion fatigue

Experimental Work

The main object of the present experimental work is to determine the relative value of organic coatings in prolonging the useful life of ferrous materials subjected to corrosion-fatigue. These materials include principally "paints" or "varnishes"[9] which may be applied either

[1] Zur Horst, C. C., and Wescott, Blaine B.

[2] Ferrous materials which have failed by corrosion-fatigue often (but not always) show many transverse cracks near the actual fracture, as illustrated in Figures 1 and 2. Figure 1 shows these typical corrosion-fatigue cracks in sucker rods, while Figure 3 shows the inside appearance of superheater tubes which had failed due to corrosion-fatigue. The similar damaged appearance of these widely differing materials is obvious. No case of failure has come to the writers' attention showing similar appearances where variable stresses and corrosion were not both present.

[3] Gough, H. J., and Sopwith, D. G., "Atmospheric Action as a Factor in Fatigue of Metals," Journal of the Institute of Metals, Vol. 49, No. 2, 1932.

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[6] Fuller, T. S., "Endurance Properties of Steel in Steam," Trans. Amer. Inst. Mining & Met. Engr., Iron & Steel Div., 1930.

[7] Fuller, T. S., "Endurance Properties of Some Well-Known Steels in Steam," Trans. Amer. Society of Steel Treating, p. 97, Dec., 1931.

[8] Harvey, W. E., "Zinc as a Protective Coating Against Corrosion-Fatigue of Steels," Metals and Alloys, Vol. 1, p. 458, April, 1930.

[9] The materials of the paint type that seem at this time to offer most promise are phenol-formaldehyde synthetic resins or rubber derivatives. Those making independent tests are invited to get in touch with the chairman of the metallurgical committee so that this work may be correlated as far as possible.

TABLE 1

General description—	Method of drying	Test series
Ordinary red lead and drying oil base	air	A
Chlorinated rubber and drying oil base	air	B
Polymerized rubber, drying oil and plasticizer	Bake—300° F.	C
Phenol-formaldehyde resin and drying oil base	Bake—425° F.	D
Phenol-formaldehyde resin, drying oil, and chromate base	air	E
Various combinations of phenol-formaldehyde resin drying oils and pigments, with the addition of aluminum powder in all finishing coats—i.e., the second and third coat of each specimen	air	F, G, H

TABLE 2—RESULTS OF STATIC CORROSION AND CORROSION-FATIGUE TESTS OF PAINT COATINGS

Test series	Nature of coatings	Condition after 40 days—static—corrosion test: Of coating	Condition after 40 days—static—corrosion test: Of steel underneath	Condition after corrosion-fatigue test: No. days protection afforded by coating	Condition after corrosion-fatigue test: Of coating	Condition after corrosion-fatigue test: Of steel underneath
A	Lead and oil	Attacked; blistered; softened	Slightly corroded			
B	Rubber derivative	Brittle; glass-like	Slight irregular corrosion	60¼	Very brittle	Relatively heavy general corrosion.
				*15⅝	Very brittle	Relatively heavy general corrosion.
C	Rubber derivative	No noticeable change	No corrosion	†30½ (did not fail)	No noticeable change	Very slight general corrosion.
D	Phenol-formaldehyde resin	No noticeable change	No corrosion	9¼	Softened	No corrosion, except severe corrosion at spot at center where failure occurred. (Faulty application?)
E	Phenol-formaldehyde resin	Last two coats attacked	Very slight corrosion			
F	Phenol-formaldehyde resin	Superficial attack	No corrosion			
G	Phenol-formaldehyde resin	No noticeable change	No corrosion	10	Somewhat embrittled	Slight general corrosion tapering off to no corrosion at less strained portion.
H	Phenol-formaldehyde resin	No noticeable change	No corrosion			

*Speed of reversal of stress on specimen, 1,790 per minute; total cycles until failure, 39,285,000. The companion test which gave 60¼ days' protection at the standard speed of 189 r.p.m. ran 17,146,000 cycles before failure. The uncoated specimen failed in 2¼ days after 692,000 reversals of the same stress. †Test discontinued.

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by spraying, dipping or brushing, and may or may not require baking. An outstanding feature is their thinness (only a few thousandths of an inch at the most) as compared with other coatings which might be considered. Another object is to encourage field tests and correlate all the work on this problem.

Any coating material that is sufficiently adherent and reasonably resistant to salt water and crude oil as found in oil wells may be expected to afford some protection against corrosion-fatigue. Tests in service under a variety of field conditions will also bring out the effect of damage to the coating due to abrasion and impact, and the influence of other factors that cannot be very well duplicated in the laboratory. The effect of accidental breaks in the coating from such causes will probably depend upon whether or not free oxygen is present in the water and the section of the metal exposed. More experimental work is required on this point.

Materials and Test Procedure

For the purpose of this investigation eight well-known types of protective coatings were selected. Many other excellent materials could have been included, but limitation of time and testing equipment made it desirable to confine the work to the ones employed. All of these materials had shown either in laboratory tests or in the field good protection against ordinary static corrosion where more or less oxygen is present. The method of testing comprised:

(a) Static corrosion tests in the chosen environment to determine the resistance of the coating to attack and penetration of moisture.[10]

(b) Corrosion-fatigue tests to study the deleterious effect of the repetition of strain on the coating, and to get some estimate of the increased life due to the protection afforded by these coatings.

The coating materials selected for the first series of tests are shown in Table 1.

Three coats of each were applied to an R. R. Moore fatigue test specimen (which has been described elsewhere[4]) following the recommendation of the manufacturer as to coating procedure, time between coats, and time after final coat before testing. The specimens for static corrosion tests were immersed vertically in the corrosive solution[10] which was kept quiescent. In the corrosion-fatigue tests the specimen was placed in an R. R. Moore machine. The solution completely surrounded the test portion of the specimen and flowed past it at a slow rate.[11] The corrosive solution was the same as that employed for the static corrosion tests.

The steel which carried the coating was .38 carbon, having an endurance limit of 42,000 pounds per square inch. In all corrosion-fatigue tests the specimen was purposely fixed at 30,000 pounds per square inch, and the speed of complete reversal of stress was 189 per minute, unless otherwise stated. The slower speed chosen by us is nearer to operating speeds where coated materials might be used in the oil industry, and at the same time is high enough to give a sufficiently large number of reversals of strain in a reasonable time. If there is no corrosion the specimen will run indefinitely at the stress employed. If an uncoated specimen is exposed to the specific conditions of this test, it will fracture in two and one-half days. Hence, the effect of a coating material in prolonging the endurance life of this steel is readily determined by subtracting two and one-half days from the time to fracture of the coated specimen. We have not reported the results in terms of numbers of cycles of stress, as the large figures involved tend to obscure the time element which is of prime importance in corrosion problems. Of course, different speeds of testing will give somewhat different results, and some of the data to be presented later show widely different results when the speed is increased to that commonly employed in fatigue work—around 1,800 complete reversals of stress per minute.

Discussion of Results

Preliminary results are given in Table 2. They indicate:

(a) That paint films definitely increase the life of metal subject to corrosion fatigue, as illustrated by tests on coatings B, C, D and G. Without any coating the specimen usually failed in less than one-fourth the time under the same conditions.

As pointed out before in this paper, from previous work by the authors,[4, 5] breaks in the coating that expose a large section of the metal on a line running around the specimen parallel to the most strained section, stimulate local corrosion and actually reduce the corrosion-fatigue value. Therefore, the results may be expected to depend largely upon maintaining a coating free from discontinuities. This stimulation of attack may not be so harmful, however, in the absence of oxygen. More work is necessary to clear up this point.

(b) The results also show that the protective power of the coating is liable to be greatly diminished under cyclic strain. An outstanding case is the B series of tests. There was definitely more corrosion on the coated corrosion-fatigue specimen which ran for only 15½ days than on the static corrosion test specimen which was exposed for 40 days.[12] Much more work will have to be done to determine which of the commercially available coating materials stand up best in oil well fluid mixtures. The American Petroleum Institute metallurgical committee (who have outlined and assigned this problem) and the authors will be glad to receive results of experience or tests on coating materials that seem promising for this purpose.

In conclusion, it is evident that some protection from corrosion-fatigue can be obtained by paint films and that the amount of protection depends to a large extent upon how long the coating will protect the metal from corrosion under the particular conditions of service without strain and the maintenance of a continuous coating on the metal.

Cyclic strain seems to decrease the protective power of the coating. Explanation of the effect of strain (with or without corrosion) on protective coatings must await the results of considerable experimental work, which is part of the present program of investigation.

The factors that control corrosion and corrosion fatigue are so numerous and variable that the results of laboratory tests should be taken only as indication of what may be expected and should be correlated with service tests on the same materials before drawing conclusions as to the practical economic value of any protective coating for this purpose.

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[10] The corrosive environment consisted of a solution in distilled water of 22,000 P.P.M. NaCl + 5,000 P.P.M. $CaCl_2$ + 3,000 P.P.M. $MgCl_2$ saturated at atmospheric temperature and pressure with H_2S and natural gas, oxygen being absent. This solution is typical of a corrosive well water and is easily reproduced.

[11] The method employed for exposing the specimens to the corrosive environment follows that developed by Dr. H. B. Wescott of the Gulf Research and Development Laboratories. On account of its ease of use and wide adaptability, particularly where it is desired to exclude oxygen, it is hoped that Doctor Wescott will publish the details of the method. In principle it consists of a hydrogen sulphide generator, a gas-mixing bottle, and a 7-liter bottle to hold the test solution. The test solution is pumped to an upper reservoir by an "air lift" (in this test the "air" was a mixture of hydrogen sulphide and natural gas free from oxygen), from which it flows over the test specimen and back to the 7-liter bottle.

[12] Microscopic examination of the coatings showed that corrosion products from the metal in Series B had been precipitated within the coating, causing it to become opaque. The coating originally was transparent. The same coating material in the static tests was only slightly discolored. The extreme embrittlement of this particular coating is ascribed primarily to chemical attack by hydrogen sulphide. It is suggested that the porosity of the coating is increased by the cyclic strain. Examination of the specimen of coating G adds weight to this suggestion. The steel underneath this coating was corroded to an extent intermediate between C and B, but the corrosion as shown by darkening and roughening of the surface tapered off to no visible corrosion at the shoulder of the test portion where the strain on the coating would be much less than at the center on account of the increased diameter of the test specimen at this point. This portion of the test specimen was freely exposed to the test solution.

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Sulphuric Acid Produced From Heavy Refinery Sludge by Use of Improved Contact Process

By S. F. SPANGLER
Chemical Construction Corp.*

The expansion of the oil-refining industry during the past two decades has resulted in refineries becoming one of the largest consumers of sulphuric acid. Their use of acid in treating oils results in the production of a black, viscous, evil-smelling mixture of indefinite composition, containing principally hydrocarbon sulphates and sulphonates and free sulphuric acid, called "acid sludge." For years the problem of disposing of this sludge and recovering its acid content for re-use has been a major study at refineries.

The best former practice consisted of the "separation" of the sludge, by treatment with steam and water, into light acid oil, acid tar, and weak sulphuric acid. This weak acid, known as "separated sludge acid," ordinarily had a strength of 30°-35° Baume (34.8 per cent-41.3 per cent sulphuric acid), and required concentration prior to re-use. Due to the tendency of the sludge acid to foam at a certain stage of concentration, owing to the decompositon of the acid by the carbonaceous materials present after even the most careful separation, the older processes of sulphuric acid concentration were generally unsatisfactory. The difficulties were first successfully overcome in 1920 by the use of the two-stage process (Hechenbleikner, U. S. Patent No. 1,421,688 et al) which is still employed in the modern drum-type concentrators so widely used in refineries.

Stronger Acid Required

However, recent progress in oil refining has resulted in the production of cracked distillates, requiring stronger acid for treatment and giving acid sludges more difficult to separate. In fact, some acid sludges cannot be separated at all. It is possible that acid sludges are going to become even more difficult to handle in the future as refinery technique improves. The acid obtained from the separation of cracked distillate sludge is frequently so high in soluble hydrocarbon content that satisfactory concentration is impossible even in the latest types of concentrators, due to the fact that during concentration these hydrocarbons tend to decompose some of the acid into sulphur dioxide, causing a heavy economic loss in addition to the liberation of objectionable gas. Also, the demand for stronger treating acids cannot be met by concentrating processes. It is impossible to concentrate sludge acid much above a strength of 90 per cent sulphuric acid, whereas for treating some highly refined products 98 per cent, and even fuming acid, is required. The purchase of fuming acid for fortifying partially concentrated acid in such cases is frequently impractical on account of the balance that must be maintained. In other words, the addition of sufficient fuming acid to 85 per cent or 90 per cent acid to give a mixture of 98 per cent strength results in producing a greater volume of acid than is required for treating.

At some refineries, sludges which are not readily separated are pumped into ponds, and no effort is made to recover their acid content. This practice involves great economic loss, and creates a public nuisance. In other cases, the sludge is destroyed by burning, with a resultant fume nuisance that may be objectionable in settled communities. Also, such a method of disposal is expensive, as the high acid content of some sludges prevents their combustion being selfsupporting—and additional fuel must be added. The gases from the combustion are usually too corrosive for economical use under stills or boilers, so that the entire operation represents a total loss of values.

It has long been known that sludge, on standing, decomposes into sulphur dioxide gas and a carbonaceous residue, and many inventors have proposed to accelerate this reaction by heat, utilizing the sulphur dioxide for the production of sulphuric acid. However, until the invention of the continuous "Chemico" sludge conversion process by I. Hechenbleikner in 1931, none of these proposals has proved to be commercially feasible.

Hechenbleikner Process

In the development of the Hechenbleikner process, a number of pertinent basic facts were established by laboratory experiments:

1. The reduction of the acid content of the sludge to sulphur dioxide by slow, controlled, progressive heating is practically quantitative.

2. The decomposition of the sludge takes place in stages. It foams, turns pasty, and finally cokes. The residue is sponge-like; and, unless crushed down, occupies several times the volume of the original sludge.

3. There is a noticeable peak in the rate of decomposition of the sludge and evolution of the gas. As the temperature is steadily increased, the maximum evolution of the sulphur dioxide takes place around 400° F. The commercial manufacture of acid in a contact plant requires a steady supply of sulphur dioxide; therefore, it is necessary that the process be made continuous to avoid fluctuations in the gas supply.

4. The reaction also produces water vapor and a small quantity of oil vapors and light fixed hydrocarbon gases varying with the character of the sludge. Since sulphur dioxide for use in a contact-acid plant must be dry and free of combustible matter, adequate means of condensing, washing and drying the gases are necessary for the complete process.

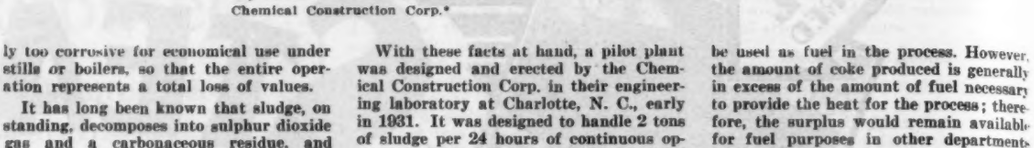
5. The residue from the sludge decomposition is brittle in some cases and pasty and asphaltic in other cases. A pasty residue would be troublesome to handle in a continuous process. The addition of a little acid to the sludge was found to prevent the formation of a pasty residue. Experiments showed that sludges containing 25 per cent and more of acid form a coke-like residue easy to handle. When sludges as strong as this in acid are not available, they can be produced by recirculation of some of the system acid.

6. The reduction is apparently due to the hydrogen atoms of the hydrocarbons, and not to the carbon atoms—as practically no carbon dioxide is formed during the heating.

7. The reaction does not produce any appreciable quantities of sulphur trioxide or sulphuric acid mist, or of hydrogen sulphide.

With these facts at hand, a pilot plant was designed and erected by the Chemical Construction Corp. in their engineering laboratory at Charlotte, N. C., early in 1931. It was designed to handle 2 tons of sludge per 24 hours of continuous operation. Light oil sludge, which remained liquid during transportation, was obtained in tank car lots, and experimental operations continued for nearly a year. Needless to say, changes were necessary in the original design of the unit, but the results finally obtained were very satisfactory.

Following the demonstrations of the pilot plant a contract was made with the W. H. Daugherty & Sons Refining Co. for the erection of a commercial plant to produce 50 tons of acid per day from hitherto unseparable medicinal oil sludges at Petrolia, Pa. Erection of this plant was begun in January, 1932, and operations commenced on sludge in June, 1932. Numerous changes in the commercial plant have been found necessary during the past 15 months of operations, but these were to be expected when designing so large a plant on the basis of results obtained with a small pilot plant. These changes have been of a mechanical nature, and the process used in the large plant is the same as that developed at Charlotte.



Diagrammatic sketch of plant using Hechenbleikner process

New Process Described

The decomposition of the sludge is produced by direct contact with a countercurrent flow of hot combustion gases in a rotary kiln sludge converter. The combustion gases can be produced from oil or gas in a suitably designed furnace which is lined with fire brick to withstand a temperature of 2,500° F., or higher. Combustion is regulated to give a low oxygen content in the combustion gases so as to prevent subsequent combustion of the inflammable constituents of the sludge and for other reasons.

The combustion gases leave the furnace at about 2,200° F., and pass directly into the rotary kiln. The success of the entire process lies in the effectiveness of this simple piece of equipment. The kiln is divided into compartments through which the sludge travels countercurrent to the gas flow, and is inclined at a slight angle to help the flow of sludge. Sliding joints, held tight by spring tension, connect the rotary element to the stationary ends, making gas-tight joints. The system is operated so that the kiln is under a slight vacuum which eliminates any possibility of a gas nuisance. The inside of the kiln is provided with ribs to lift the material during the slow rotation of the kiln. The dry granular residue is discharged at the hot end of the kiln into a closed screw conveyor, which removes it to a storage bin for future use as a fuel. This residue is normally acid-free and suitable for burning as pulverized fuel—being high in volatiles and low in ash. If desired, the coke residue may be used as fuel in the process. However, the amount of coke produced is generally in excess of the amount of fuel necessary to provide the heat for the process; therefore, the surplus would remain available for fuel purposes in other departments of the refinery, or for sale.

Though the combustion gases enter the kiln at 2,200° F., there is no overheating of the material, and it is the aim of the operator to discharge the coke residue at a temperature of about 500°-550° F. The temperature of the gases leaving the kiln is held at 250°-300° F. by controlling the rate of sludge feed, volume of air, and fuel used.

The sludge is pumped into the kiln at the gas-exit end. The character of the sludge determines the type of pump most suitable. For heavy sludge, screw conveyors or gear pumps have been found satisfactory. For light sludge reciprocating pumps may be used.

The gas from the rotary kiln is surprisingly high in sulphur dioxide. Twenty per cent sulphur dioxide is easily attainable from the average sludge. As the gas leaves the kiln, it passes next through a series of washers, which cool the gases and condense the water of reaction and the volatile oils. The gases are cooled and washed by direct contact with water. Sulphur dioxide is soluble in cold water; and, unless the same water is used and re-used, the loss to the process by direct contact washing would be too great. To avoid this loss, the wash water is cooled by circulation through water-cooled coils, or equivalent means, and re-circulated through the washer. Only the quantity equivalent to the water condensed from the gases is discharged from the system. This water is discharged while still warm and, therefore, with very low sulphur-dioxide content, so that the loss of acid from this cause is negligible.

Oil Recovery Varies

After cooling and before re-use, the circulating wash water passes through a receiving tank, where the condensed oil vapors are separated from the water and pumped away for use as a fuel. The amount of oil recovered varies with the type of sludge, and in some cases may be of considerable quantity. In the treatment of some types of sludge it has been found desirable to use 50 per cent to 60 per cent acid instead of water in the second washer, as acid of this strength is apparently very efficient in condensing certain oil vapors. The scrubbing acid is not strong enough to attack or absorb the oil, and may be used continuously—requiring only occasional replenishing to maintain its strength.

After passing through the washers, the gas is comparatively clean, but still contains the small quantities of fixed hydrocarbon gases produced in the sludge converter. These are eliminated by oxidation in a secondary combustion furnace. Air, sufficient for the oxidation of the

*Presented at Chicago meeting of A. P. I., October 26 to 28.

fixed gases and the oil of the pilot flame, is admixed with the plant gases before they enter the furnace. When a secondary furnace is used, the gases are subsequently cooled by passage through one or more washers operating with a closed water cycle in the same manner as the first series of washers. The gases are next thoroughly dried by passage through a drying tower fed with sulphuric acid or 85 per cent-93 per cent strength. This drying is very important, since any moisture present in the gases would cause serious trouble in the contact-acid plant.

The subsequent procedure is similar to that in a plant for the manufacture of sulphuric acid from cold sulphur dioxide by the contact or catalytic process. As the gases entering the dryer do not contain sufficient oxygen to complete the reaction in the catalytic converter, sufficient air is drawn into the system at the inlet of the drying tower to bring the oxygen content to about 1.4 times the sulphur dioxide content of the mixture.

A centrifugal blower in the system, following the drying tower, serves to maintain a vacuum through the purification equipment and the rotary kiln, thus preventing the escape of any sulphur dioxide into the atmosphere of the plant. From the time the gases leave the blower until they leave the plant, they remain under pressure furnished by the blower.

The cool dry mixture of sulphur dioxide, combustion gases, and air, now under pressure, passes through a heat exchanger where it is heated to the proper temperature for admission to the catalytic converter. In this converter it is passed through a vanadium catalyst which causes the oxidation of the sulphur dioxide to trioxide with evolution of heat. The hot exit gases from the converter are passed through the heat exchanger, so that this reaction heat is utilized to preheat the entering gases. The modern vanadium catalyst readily converts 96 per cent-98 per cent of the dioxide to trioxide.

The sulphur trioxide from the converters is then absorbed in one or more absorbers to produce either fuming acid (oleum, 104 per cent sulphuric acid or stronger) or 98 per cent acid, as may be desired. If fuming acid is produced, the final absorber is charged with 98 per cent acid in order to secure the maximum efficiency of absorption. The strength of acids in the various drying and absorbing vessels are maintained at the desired points by the interpumping of small quantities of acid from one vessel to the other, and the withdrawal of the excess acid, as product, to the refinery's acid storage tanks.

A recovery of about 90 per cent of the acid content of the sludge may be expected from this process. With an average treating loss of 10 to 15 per cent of acid, this would give an over-all loss to the refinery of 20 to 25 per cent—a much lower loss than is possible with the best of the old recovery methods. By proper mixing of sludges in the refinery, they remain sufficiently liquid for pumping and processing. It has been found that acid sludges can be so thoroughly mixed that they will not stratify.

Costs of New Process Lower

The costs of recovering acid by this method are far less than the older separation and concentration process.

The average daily requirements of a plant producing 50 tons of 98 per cent sulphuric acid daily from average refinery acid sludge would be approximately as follows:

1 superintendent.
3 operators (1 per 8-hour shift).
9 helpers (3 per 8-hour shift).
3,000 to 4,000 kwh. electrical power.
1,000,000 gal., 75° F., cooling water.
1,500 gal. fuel oil.

At current prices, these are equivalent to an operating cost of approximately $4 per ton of 100 per cent acid produced, exclusive of fixed charges and overhead, but also without crediting any value to the coke produced.

Furthermore, the total acid costs of the refinery may be reduced still further by a possible modification of this sludge-conversion process. It is obvious that only the heat content of the combustion gases is utilized in the decomposition of the sludge, and the nature of the gases is otherwise immaterial as long as they contain little free oxygen. If instead of producing this heat by the combustion of oil or gas, the waste hydrogen sulphide gas available at many refineries, or even purchased sulphur, is burned—a hot sulphur dioxide is produced which is equally suitable for the decomposition of the sludge, and at the same time serves to produce that much more acid when the gases enter the contact unit. As no more labor or power is required for burning hydrogen sulphide or sulphur than for burning oil, the effect is to produce additional acid at the cost of only the raw material and a slightly larger investment in catalyst capacity. These are more than balanced by elimination of the cost of fuel oil or gas that would otherwise be used for heating the kiln.

Thus it is possible for a refinery with this sludge-conversion plant to be entirely selfcontained as regards sulphuric acid by burning enough hydrogen sulphide or sulphur to replace its over-all acid losses.

Advantage to Modern Refinery

This new process of handling sludges will unquestionably appeal to the modern refineries because:

1. It avoids the expense and trouble of separating the acid sludge with the resultant fume nuisance.

2. It means a substantial saving in treating cost.

3. It produces acid of any desired strength.

4. The coke residue is a fuel of value, and in such shape that it can be utilized without difficulty.

5. It provides, for the first time, a satisfactory means of sludge disposal—a process that handles even unseparable acid sludges and ends for all time one of the worst nuisances in the refinery yard.

The results obtained in the commercial installation of this process in Petrolia have been highly successful. However, the developers are continuing their research program at their pilot plants at Charlotte, N. C., and at Warners, N. J., on the various acid sludges now being turned out by refineries, with a view of covering the entire range of sludges as thoroughly as possible, with an eye toward any betterments in the process which can be developed and passed on to their customers—and they propose to continue this service. Naturally, the essential features of the process and special apparatus employed therein have been protected by patents issued and pending in all of the principal oil refining countries of the world.

"GEOPHYSICAL PROSPECTING"

"Elements of Geophysical Prospecting," a booklet prepared by Dr. C. A. Heiland, professor of geophysics in the Colorado School of Mines at Golden, as an explanation of the geophysical prospecting exhibit at the Century of Progress exposition in Chicago, might well be termed a primer of geophysics. It not only describes the exhibit but presents an elementary discussion of the principles involved in geophysical methods which find application in the oil industry. The booklet, which contains 52 pages, with many illustrations, has been published as the Colorado School of Mines Quarterly, Volume 28, No. 4.

STILL BUYING GASOLINE

Gene—Bill, has the depression hit you yet?

Bill—I'll say it has. First I lost mah job an' went back to father's to live; sent my two chillun to de orphans' home; my wife went back to her mother, and I shot mah dog.

Gene—That's bad.

Bill—Yes; if times gits any worse, I's afraid I'll have to give up mah car.—Wall Street Journal.

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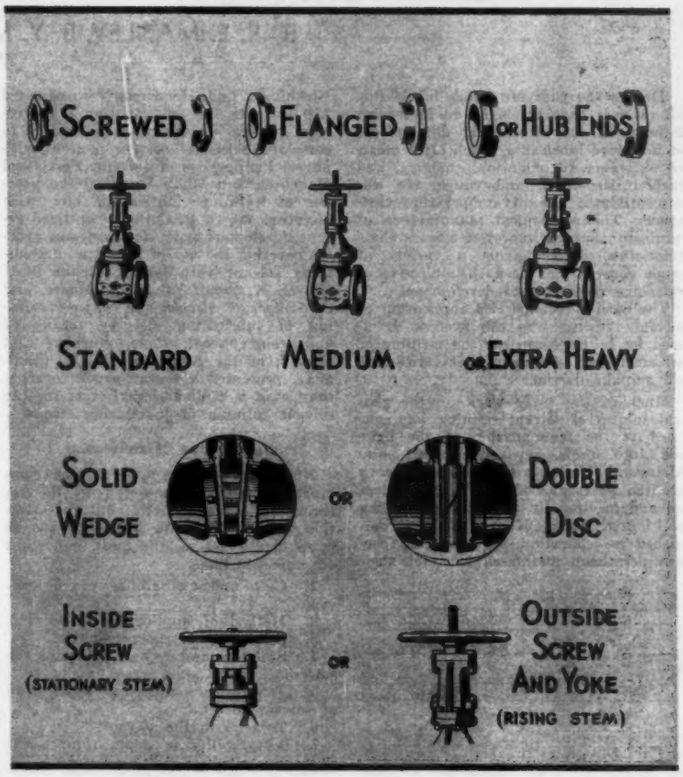

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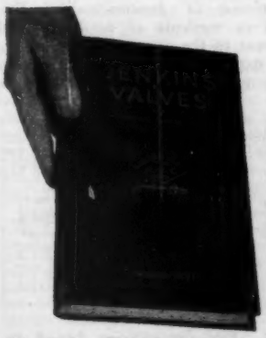

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Use Furfural as the Extraction Solvent to Make Motor Oils Having Low Viscosity Index

By R. E. MANLEY, B. Y. McCARTY and H. H. GROSS
Texas Co.*

During the past few years lubricating oil refiners have displayed an increasing interest in the commercial development of improved lubricants which offer greater resistance to oxidation, sludging, and carbon deposition, and which are less susceptible to viscosity-temperature variations. The economical manufacture of lubricants having improved service characteristics, derived from a variety of crude sources, has been the objective of extensive research and development.

The earliest commercial application of solvent refining was the process developed by L. Edeleanu for the refining of kerosene and lubricating oils with liquid sulphur dioxide.

Much of the early work on the general subject of solvent refining was confined to the fractionation of the light oils into their separate constituents. Aisinman[1] effected a separation of heavy naphtha by means of dissolving in alcohol and fractionally precipitating by the addition of water. Kharitchkoff[2] accomplished a separation by dissolving certain petroleum distillates in amyl alcohol and fractionally precipitating by the addition of ethyl alcohol. M. A. Rakusin[3] in a publication in 1906 described work of Butleroff, carried out as early as 1870, on the cold fractionation of hydrocarbon mixtures by means of solvents. Riche and Halphen[4], 1894, studied the selective separation of lubricating oils and residua by means of chloroform and alcohol. E. Valenta[5] studied the separation of aromatic constituents from petroleum distillates by means of dimethyl sulphate. Schwartz and Schulter,[6] in 1911, first discussed the solvent refining of motor oils with acetone. Moore, Egloff, and Morrell[7], in 1918, presented an article on solubility and separation of various types of hydrocarbons in liquid sulphur dioxide. Egon Eichwald[8], in U. S. Patent 1,550,523, disclosed the use of furfural for the purification of hydrocarbon oils. Numerous other patents have been taken out from time to time covering use of organic acids, ketones, anhydrides, and alcohols. C. F. Maybery[9], in studying the heavy fractions of petroleum, proposed the fractionation of hydrocarbons by means of a mixture of ether and ethyl alcohol. H. M. Smith[10], U. S. Bureau of Mines Technical Paper No. 477, describes the fractionation of Cabin Creek crude lubricating fractions by means of acetone, ethyl acetate, secondary butyl alcohol, and nitrobenzene.

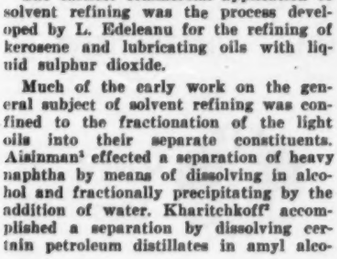


Fig. 1.—Raffinate yield percent by volume

Recent Developments

Recently H. Steinbrecker[11] discussed the solvent fractionation of lignite tar by means of α-dichlorhydrin, ethylene chlorhydrin, and benzyl alcohol. Bergstrom, Gikey, and Lung[12] determined the solubility of 250 organic compounds in seven of the aliphatic amines at temperatures between 5 and 25° C. Ferris, Birkhimer, and Henderson[13] investigated 110 solvents for fractionation of petroleum lubricating oils, and endeavored to correlate selective solvent action with physical properties of solvent. Ferris and Houghton[14], in 1932, described the process of refining lubricating oils with nitrobenzene. O. P. Cottrell[15] outlined recent developments in the Edeleanu process covering the use of benzol as a modifying solvent with liquid sulphur dioxide. R. K. Stratford, H. H. Moore, and S. Pokorny[16] discuss the solvent refining of lubricating oils by means of anhydrous phenol. Page, Buchler, and Diggs[17], of the Standard Oil Co. (Indiana), presented a recent paper covering the use of β, β'-dichlorethyl ether for the solvent refining of lubricating stocks.

*Delivered before Refining Group at A.P.I. convention in Chicago, October 25-28, 1933.

Selection of Solvent

Numerous solvents and solvent combinations may be employed in the refining of lubricating oils; but the selection of a solvent for refining depends upon many factors, the most important of which include:

1. Cost and availability of the solvents.
2. Method of application of solvent.
3. Selectivity of the solvent.
4. Stability and recoverability of the solvent.
5. Temperature range of application of solvent to oil.
6. Toxicity of the solvent.
7. Adaptability in application to various type stocks.

1. Cost and Availability of Solvent.—It is apparent that a solvent must be selected which is readily available in large quantities and which can be obtained at a reasonable cost, considering the solvent losses encountered in plant operation.

2. Method of Application of Solvent.—Five methods of application of the solvent to the oil are possible:

(a) Solution of the oil in the solvent followed by separation of the raffinate by cooling or by changing solvent composition by means of a modifying solvent.

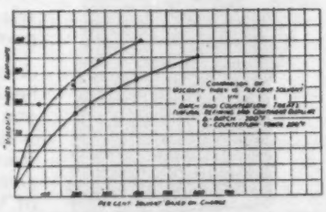


Fig. 2.—Percent solvent based on charge

(b) Batch extraction by mixing, settling, and decanting.

(c) Multiple-batch extraction, which employs a fresh portion of solvent in several successive batch extractions.

(d) Batch or step counterflow extractions, consisting of passing oil and solvent in counterflow through a number of separate mixers and settlers.

(e) Continuous counterflow extraction in a single apparatus.

In refining lubricating oils with solvents it is desirable, if possible, to employ the continuous method of contacting the solvent with an oil; and, in selecting the best solvent for refining, consideration must be given to obtaining intimate contact between the solvent and the most viscous oil and effecting the rapid separation of the extract and refined oil layers.

3. Selectivity of the Solvent.—The term selectivity as applied to lubricating oil constituents has been the subject of considerable study and controversy. In the study of selective action of solvents, viscosity index and gravities have been found useful as guides to separation—although viscosity index and gravities alone are not necessarily a criterion of quality. It is generally conceded that the most selective solvent is that solvent which removes the minimum of high viscosity index material when effecting a given increase in viscosity index of a lubricating stock. The discussion of the term "selectivity" will be considered hereafter.

4. Stability and Recoverability of the Solvent.—Obviously, the solvent employed in refining lubricating oils must not react with constituents of the lubricating stock, and must be stable under conditions employed in contacting the solvent with the oil and in the recovery of the solvent from the separate fractions. In general, the solvent employed should have sufficient volatility to be recoverable at a low enough temperature to insure complete removal from the oil fractions without maintaining excessively high operating temperatures in the process.

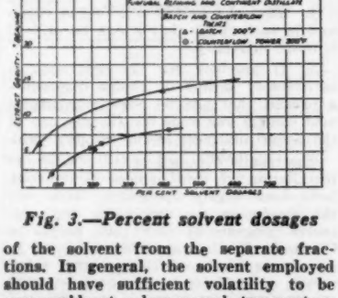


Fig. 3.—Percent solvent dosages

5. Temperature of Application of Solvent.—In as much as the solvent refining process should be capable of handling oils of a wide range of viscosity, it is apparent that those solvents which are applied at elevated temperatures may be expected to possess considerable advantage over those applied at reduced temperatures. High operating temperatures allow the solvent extraction of viscous and waxy oils without the difficulty of low settling rates and poor contact between the solvent and the oil.

6. Solvent Toxicity.—Another practical consideration in the selection of the solvent is toxicity. Very poisonous solvents must necessarily be employed in completely enclosed systems, and adequate provision must be made for protecting the workmen against poisoning by accidental contact with the solvent or its vapors.

7. Adaptability in Application to Various Type Stocks.—A solvent to be employed, generally, in the petroleum industry for the refining of lubricating oils must be capable of application to both residual and distillate oils derived from any type of crude oil.

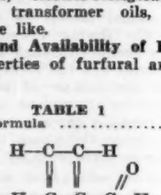
In selecting a solvent for economically refining a wide variety of lubricating stocks for the production of high grade lubricating oils, many solvents have been investigated in the laboratories of the Texas Co.; and, as a result of the extensive investigations carried out, it has been found that furfural fulfills the requirements outlined above for a superior refining solvent on account of its relatively low cost, its availability in large quantities, high selective action on a wide variety of stocks, stability in solvent-recovery operations, adaptability to counterflow operations, and its non-poisonous properties. Furthermore, furfural lends itself readily to the production of special oils such as high grade turbine oils, electric-refrigerator oils, white oils, transformer oils, airplane oils, and the like.

1. Cost and Availability of Furfural

The properties of furfural are shown in Table 1.

TABLE 1

Structural formula .....



Boiling point, °F.	323
Freezing point, °F.	—34
Specific gravity at 20° C., sec.	1 1622
Vis. at 100° F., Saybolt Uni. sec.	28.7
Specific heat (68 to 212° F.)	0 416
Heat of vaporization (29.9 in. mercury), B.t.u. per lb.	193.5
Vapor pressure at 100° F., m.m.	10
Flashpoint, °F. (Tagliabue c. p.)	138
Solubility in water (96° F.), per cent by volume	5.9

Data taken from Miner Laboratories Bulletin, "Furfural and Its Derivatives."

The raw material source in the manufacture of furfural is agricultural wastes, such as oat hulls, straw, corn cobs, rice hulls, etc. Its production in commercial practice is comparatively simple, and good yields of solvent are obtained from relatively inexpensive waste materials. Furfural compares favorably in price with practically all of the commercially available refining solvents.

2. Method of Application

Figure 1 illustrates the variation of viscosity index with raffinate yields obtained in the furfural refining of an untreated acetone-benzol dewaxed Mid-Continent distillate lubricating stock having a viscosity index, before treatment, of 53. Tests on the charge oil are given in Table 2.

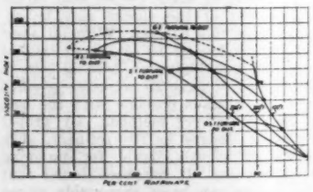


Fig. 4.—Percent raffinate

TABLE 2

Gravity, °A.P.I.	21.6
Flashpoint, °F. (Cleveland o. c.)	450
Firepoint, °F. (Cleveland open cup)	545
Vis. at 100° F., Saybolt Universal	1,168
Vis. at 210° F., Saybolt Universal	79
Pourpoint, °F. (A.S.T.M.)	—5
Carbon residue, per cent	0.87

In Figure 1 the effect of counterflow extraction as compared to batch extractions is clearly shown. The counterflow extractions of this diagram were made in a counterflow tower packed with approximately 12 feet of Raschig rings. All extractions were carried out at temperatures of 200 to 220° F.

Figure 2 illustrates the variation in solvent requirements for obtaining various viscosity indices on the oil shown in Table 2 and Figure 1. Thus, it is pos-

sible to obtain the same results in counterflow extraction with a little less than one-half of the solvent required in batch extractions.

Due to the high temperature of application of furfural to lubricating oils, it is possible to employ continuous countercurrent action in a counterflow tower equipped with suitable provision for distributing the solvent and oil and means for the prevention of "channeling." At temperatures of 200 to 250° F., where furfural is usually applied, it is possible to process oils of extremely high viscosity, or oils having very high wax content, without involving settling difficulties. The rates of flow have been found to range between 420 and 1,680 gallons of charge oil per square foot of tower cross sectional area per 24 hours, the lower rates being employed on stocks of high viscosity. The usual practice in countercurrent extraction with furfural consists in holding the counterflow apparatus or tower nearly full of oil and maintaining low solvent quantities within the extraction apparatus. This practice greatly reduces the amount of solvent necessary in the refining plant, and tends to keep solvent losses at a minimum.

3. Selectivity of Furfural

Figure 3 illustrates the relation between solvent dosage and extract gravity in furfural refining Mid-Continent distillate. It is noted from Figure 3 that a much heavier gravity extract is obtained in counterflow extraction than in batch extraction. The curves of Figure 3 illustrate the high degree of selectivity obtained with furfural and the absence of solvent action on the lighter gravity constituents.

Figure 4 is presented to illustrate the variation in solvent power of furfural with increasing temperature in batch extraction. Curves are shown for extraction of a different Mid-Continent lubricating stock with varying solvent quantities at 100° F., 200° F., and 250° F. It is believed that the slope of each curve is a relative measure of the selectivity of the solvent under the conditions specified for that curve. It must be remembered, however, that these curves were plotted from the results obtained in batch extractions; but, as indicated above, much better results would be obtained had counterflow extractions been employed.

It is probable that the solvent begins to lose its selectivity above a temperature somewhere between 225 and 250° F., since the constant dosage curves in Figure 4 tend to go through a maximum.

4. Stability and Recoverability of Furfural

In recovering the solvent from the two liquid layers obtained in furfural extraction, two separate solutions are involved, viz., extract solution and refined-oil solution. The composition of these solutions is shown approximately as follows, for an extraction employing 200 per cent furfural, by volume:

	Per cent	
	Extract solution	Refined-oil solution
Furfural	90	10
Oil	10	90

Recovery of the solvent by vacuum distillation permits operation at vapor temperatures of 210 to 230° F., and at these temperatures it is possible to allow more complete removal of furfural from the oil under moderate operating conditions.

At oil temperatures of 375° F., or above, under 28-inch vacuum, experience has shown that no furfural can be detected in the stripped oils; but provision is made in plant operation to avoid losses in the stripped oils by steaming the remaining traces of furfural from the hot oil, leaving the dry vacuum-stripping unit. Recovery of furfural from the steamings is accomplished by a fractionating system designed after the principles laid down by Mains[20 21].

Furfural must be kept free from mineral acids, caustic alkali, and ammonia, and should be protected against severe oxidizing conditions. In general, it has been found preferable to recover the solvent under reduced pressure in order to keep solvent quantities in stripped oil at a minimum and in order to prevent polymerization of the extract to a solid or semisolid condition due to excessive heat. Under reasonably controlled operating conditions furfural is very stable, and plant losses will not exceed 0.2 per cent on the basis of the total solvent used in processing.

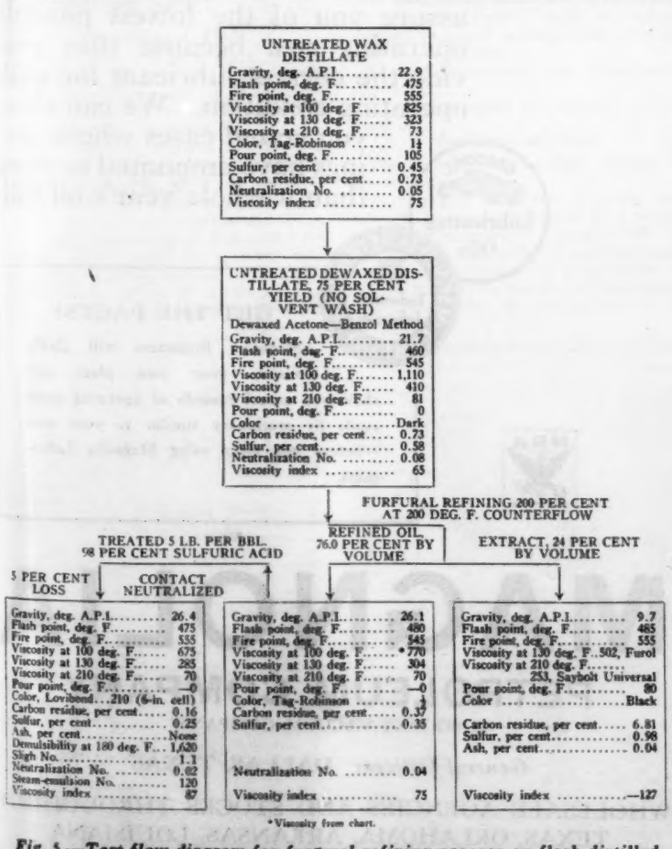

UNTREATED WAX DISTILLATE
Gravity, deg. A.P.I. 22.9
Flash point, deg. F. 475
Fire point, deg. F. 555
Viscosity at 100 deg. F. 825
Viscosity at 130 deg. F. 323
Viscosity at 210 deg. F. 73
Color, Tag-Robinson 14
Pour point, deg. F. 105
Sulfur, per cent 0.45
Carbon residue, per cent 0.73
Neutralization No. 0.05
Viscosity index 75
UNTREATED DEWAXED DISTILLATE, 75 PER CENT YIELD (NO SOLVENT WASH)
Dewaxed Acetone—Benzol Method
Gravity, deg. A.P.I. 21.7
Flash point, deg. F. 460
Fire point, deg. F. 545
Viscosity at 100 deg. F. 1,110
Viscosity at 130 deg. F. 410
Viscosity at 210 deg. F. 81
Pour point, deg. F. 0
Color Dark
Carbon residue, per cent 0.73
Sulfur, per cent 0.58
Neutralization No. 0.08
Viscosity index 65
FURFURAL REFINING 200 PER CENT AT 200 DEG. F. COUNTERFLOW
TREATED 5 LB. PER BBL. 98 PER CENT SULFURIC ACID
5 PER CENT LOSS
CONTACT NEUTRALIZED
REFINED OIL, 76.0 PER CENT BY VOLUME
EXTRACT, 24 PER CENT BY VOLUME
Gravity, deg. A.P.I. 26.4
Flash point, deg. F. 475
Fire point, deg. F. 555
Viscosity at 100 deg. F. 675
Viscosity at 130 deg. F. 285
Viscosity at 210 deg. F. 70
Pour point, deg. F. —0
Color, Lovibond 210 (6-in. cell)
Carbon residue, per cent 0.16
Sulfur, per cent 0.25
Ash, per cent None
Demulsibility at 180 deg. F. 1,620
Sligh No. 1.1
Neutralization No. 0.02
Steam-emulsion No. 120
Viscosity index 87
Gravity, deg. A.P.I. 26.1
Flash point, deg. F. 480
Fire point, deg. F. 545
Viscosity at 100 deg. F. *770
Viscosity at 130 deg. F. 304
Viscosity at 210 deg. F. 70
Pour point, deg. F. —0
Color, Tag-Robinson 3
Carbon residue, per cent 0.37
Sulfur, per cent 0.35
Neutralization No. 0.04
Viscosity index 75
Gravity, deg. A.P.I. 9.7
Flash point, deg. F. 485
Fire point, deg. F. 555
Viscosity at 130 deg. F. 502, Furol
Viscosity at 210 deg. F. 253, Saybolt Universal
Pour point, deg. F. 80
Color Black
Carbon residue, per cent 6.81
Sulfur, per cent 0.98
Ash, per cent 0.04
Viscosity index —127
*Viscosity from chart.

Fig. 5.—Test flow diagram for furfural-refining process on flash-distilled paraffinic lubricating stock from Mid-Continent crude

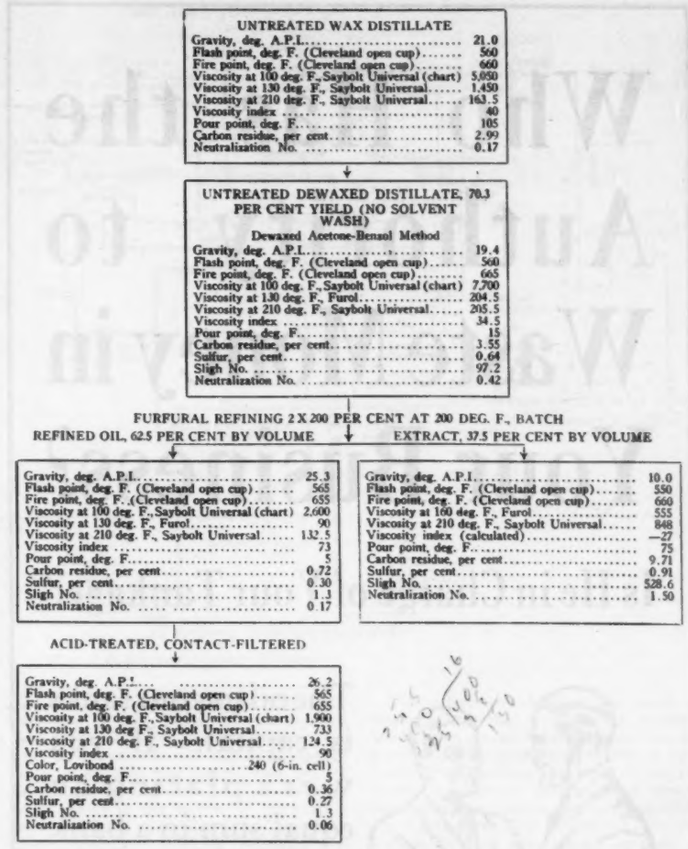

UNTREATED WAX DISTILLATE
Gravity, deg. A.P.I. 21.0
Flash point, deg. F. (Cleveland open cup) 560
Fire point, deg. F. (Cleveland open cup) 660
Viscosity at 100 deg. F., Saybolt Universal (chart) 5,050
Viscosity at 130 deg. F., Saybolt Universal 1,450
Viscosity at 210 deg. F., Saybolt Universal 163.5
Viscosity index 40
Pour point, deg. F. 105
Carbon residue, per cent 2.99
Neutralization No. 0.17
UNTREATED DEWAXED DISTILLATE, 70.3 PER CENT YIELD (NO SOLVENT WASH)
Dewaxed Acetone-Benzol Method
Gravity, deg. A.P.I. 19.4
Flash point, deg. F. (Cleveland open cup) 560
Fire point, deg. F. (Cleveland open cup) 665
Viscosity at 100 deg. F., Saybolt Universal (chart) 7,700
Viscosity at 130 deg. F., Furol 204.5
Viscosity at 210 deg. F., Saybolt Universal 205.5
Viscosity index 34.5
Pour point, deg. F. 15
Carbon residue, per cent 3.55
Sulfur, per cent 0.64
Sligh No. 97.2
Neutralization No. 0.42
FURFURAL REFINING 2 X 200 PER CENT AT 200 DEG. F., BATCH
REFINED OIL, 62.5 PER CENT BY VOLUME
EXTRACT, 37.5 PER CENT BY VOLUME
Gravity, deg. A.P.I. 25.3
Flash point, deg. F. (Cleveland open cup) 565
Fire point, deg. F. (Cleveland open cup) 655
Viscosity at 100 deg. F., Saybolt Universal (chart) 2,600
Viscosity at 130 deg. F., Furol 555
Viscosity at 210 deg. F., Saybolt Universal 132.5
Viscosity index 73
Pour point, deg. F. 5
Carbon residue, per cent 0.72
Sulfur, per cent 0.30
Sligh No. 1.1
Neutralization No. 0.17
Gravity, deg. A.P.I. 10.0
Flash point, deg. F. (Cleveland open cup) 550
Fire point, deg. F. (Cleveland open cup) 660
Viscosity at 160 deg. F., Furol 555
Viscosity at 210 deg. F., Saybolt Universal 848
Viscosity index (calculated) —27
Pour point, deg. F. 75
Carbon residue, per cent 9.71
Sulfur, per cent 0.91
Sligh No. 528.6
Neutralization No. 1.50
ACID-TREATED, CONTACT-FILTERED
Gravity, deg. A.P.I. 26.2
Flash point, deg. F. (Cleveland open cup) 565
Fire point, deg. F. (Cleveland open cup) 655
Viscosity at 100 deg. F., Saybolt Universal (chart) 1,900
Viscosity at 130 deg. F., Saybolt Universal 733
Viscosity at 210 deg. F., Saybolt Universal 124.5
Viscosity index 90
Color, Lovibond 240 (6-in. cell)
Pour point, deg. F. 5
Carbon residue, per cent 0.36
Sulfur, per cent 0.27
Sligh No. 1.3
Neutralization No. 0.06

Fig. 6.—Test flow diagram for batch furfural-refining flash-distilled paraffinic lubricating stock from Mid-Continent crude

5. Temperature of Application

One definite advantage in employing furfural in solvent refining lies in the high temperature of application of this solvent to lubricating stocks. Temperatures between 100 and 250° F. (usually around 200° F.) are employed when furfural is applied to oils. Thus, it is possible to handle extremely viscous or waxy oils with efficient contact between solvent and oil and very rapid settling; and, as pointed out above, this fact alone simplifies the solvent-refining operation and reduces the amount of solvent inventory necessary in any given plant.

Figure 4 illustrates the change of solvent action of furfural on the desirable lubricating constituents with changes in temperatures. In order to obtain fractionation of extract from refined oil it has been found preferable to employ a temperation gradient between the terminal of a counterflow system. For example, in employing 200 per cent of solvent, by volume, the furfural would enter the counterflow system at a temperature of approximately 225° F., while the charge oil would enter at the opposite end of the system at a temperature of approximately 100° F. In this manner it is possible to obtain improved fractionation of the more desirable oil from the extract and increase the yield of refined oil to an appreciable extent. Thus, it is possible to utilise the wide temperature range of applicability to a real advantage in the case of furfural.

6. Toxicity of Furfural

One of the outstanding advantages in the use of furfural is its low toxicity, a very important advantage from the standpoint of operation and repair. In contact with the skin it is no more irritating than kerosene, but produces some discoloration. Vapors in moderate concentrations can be inhaled without noticeable after effect or discomfort. Experience in the manufacture and use of this solvent over a number of years has demonstrated that no ill effects whatsoever are encountered when the solvent is handled with reasonable care[22].

7. Application to a Wide Variety of Stocks

Table 3 presents data obtained in the furfural refining of lubricating stocks from a wide variety of crude sources. The extractions in this table are presented only to demonstrate the wide range of applicability of furfural to lubricating stocks. It must be emphasized that these extractions were all carried out in batch; and that had the extractions been carried out in counterflow, much higher yields would have resulted, and the solvent requirements would have been materially reduced. A number of extractions presented in Table 3 were carried out on undewaxed oil, dewaxing being accomplished after the furfural-refining operation. In general, it has been found that dewaxing should precede solvent refining on most lubricating stocks.

The results of Table 3 indicate that furfural is very effective in refining both distillate and residual oils from a very wide variety of sources.

Dewaxing of Stock

The sequence of refining steps has received considerable attention in the development of the furfural-refining process. The conclusions in this respect are that solvent refining generally should be carried out on dewaxed oils, since solvent-refining operation on raw waxy stocks involves a concentration of the wax in the raffinate portion, and a consequent increased loss of a more valuable oil results in the subsequent dewaxing step. While it is possible that dewaxing may follow solvent refining more economically on some lubricating stocks, it is felt that in most instances this concentration of wax makes solvent refining after

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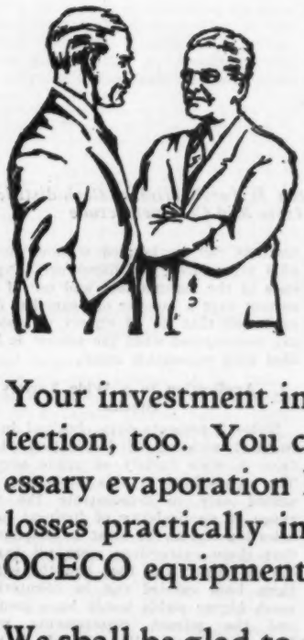

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dewaxing the preferable and most economical procedure.

It is particularly important in solvent refining that a dewaxing process be employed which completely removes wax, thereby eliminating the possibility of an increase in cold test on account of removal of extract materials.

The acetone-benzol dewaxing process, as described by Govers and Bryant[13], has been found to be very effective on lubricating distillate stocks from very low viscosities up to viscosities as high as 160 seconds at 210° F., Saybolt Universal. This process has been successful in dewaxing treated residual oils as well as distillate oils.

Figure 5 illustrates the processing of distillate paraffinic lubricating stock from Mid-Continent crude for the production of solvent-refined S.A.E. 40 oil.

Figure 6 illustrates the similar processing of a heavy paraffin distillate from the same type Mid-Continent crude. The extraction carried out in this particular case was by the batch method.

Processing of the two distillates illustrated in Figures 5 and 6 demonstrates the wide range of applicability of both solvent-dewaxing and furfural refining.

Acid Treatment

It is entirely practical and economical to eliminate acid treatment in the furfural refining of distillate lubricating oils. Contact filtration of the solvent-refined distillate oil results in excellent color and cast without the use of any acid whatsoever. However, the employment of a light acid treatment of the order of 3 to 6 pounds of acid per barrel, followed by contact filtration, will yield a much better colored product, and will result in a further improvement in quality and a further increase in viscosity index.

The balance between solvent and acid requirements can be successfully worked out for any given lubricating stock; and this is a problem which each individual refiner must consider in his own manufacturing operations.

Reference to Figures 5 and 6 illustrates clearly the improvement accomplished on solvent-refined oil resulting from a light acid treat.

Description of Plant

At the present time a plant capable of processing 750 bbls. of oil per day is under construction, and it is expected that this plant will be in full operation sometime before November 1.

Plant facilities required for furfural refining of lubricating stocks consist of the following main operating units as shown in the flow diagram (Figure 7).

1. Vertical counterflow extraction tower with preheaters or exchangers for furfural and charge oil together with means for charging solvent and oil at a predetermined controlled charge rate.
2. Storage for refined-oil solution and extract solution for supplying charge to strippers.
3. Extra-stripping unit for vacuum distillation of furfural from extract solution.
4. Refined-oil-stripping unit for vacuum distillation of furfural from the refined-oil solution.
5. Solvent-recovery system including vapor heat exchanger, condenser, and water cooler, accumulator drum, vacuum pump after cooler and receiver.
6. Two open steam strippers for removal of final traces of furfural from raffinate and extract, respectively.
7. Separating tower and fractionator for recovering furfural from the steamings and drying of furfural prior to its return to the system.
8. Slop solvent and new solvent storage tanks.
9. Storage tanks for extract and refined oil.

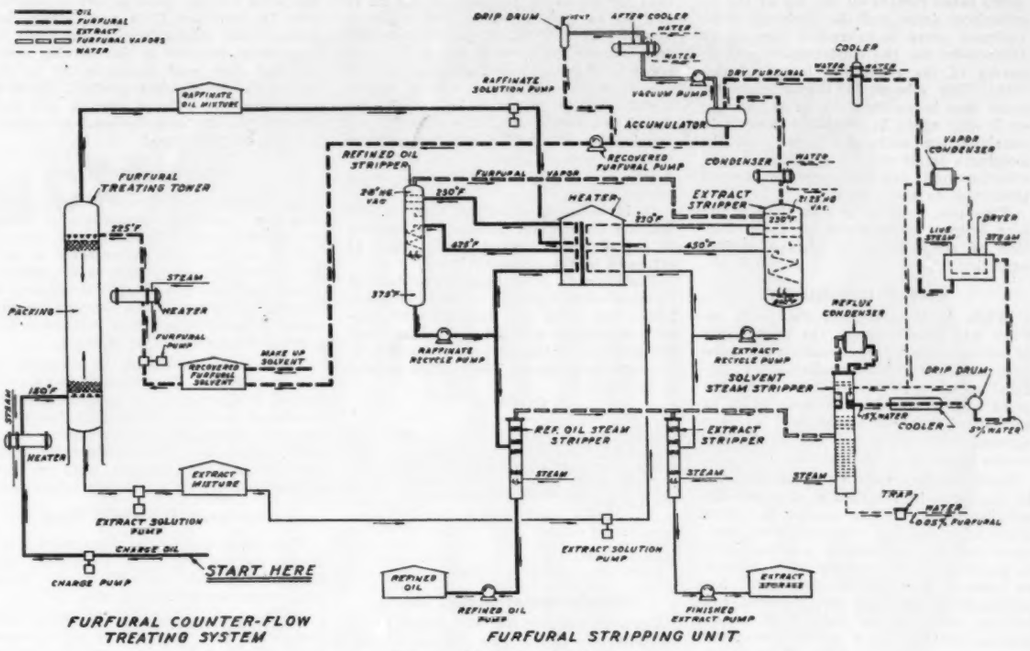

Fig. 7.—Furfural plant layout

Operation of Plant

The operation of the plant consists in the following steps:

1. Charging untreated oil to the bottom of the extraction tower at a predetermined temperature, usually 150 to 200° F., together with the predetermined amount of furfural at a temperature of 200 to 225° F. to the top of the extraction tower below the settling portion of the tower. Allowable charge rates vary between 10-bbl. charge oil per square foot of overall tower area per 24 hours for the high viscosity oils up to a charge rate of 40 bbls. per square foot per 24 hours for the medium to low viscosity oils. Levels in the bottom of the extraction tower are controlled by a duogravity float controller which regulates the amount of outgoing extract solution and maintains a solution level in the bottom of the extraction tower. Refined oil solution and extract solution flow from the extraction tower by gravity to surge tanks provided for each of these fractions. Provision is made in each of these surge tanks for removal of any slight accumulation of extract or refined oil carryover from the extraction.
2. The refined-oil mix is charged at a constant rate to the refined-oil stripping tower through the economizer section of the refined-oil heater, where the temperature is raised to approximately 230 to 250° F. The preheated vapor and liquid is then delivered into the refined-oil stripping tower, which is carried under a vacuum of about 28 inches of mercury. The vaporization of the remainder of the solvent in the refined-oil solution is accomplished by direct contact with hot oil being circulated through the refined-oil heater.

The refined oil leaving the tower is flashed into the steaming-out column, where open steam is injected into the oil for the removal of final traces of furfural. This steaming-out tower is carried under atmospheric pressure, the steamings being combined in the furfural-recovery fractionator. The refined oil from the bottom of the steaming-out column is withdrawn and pumped through the interchanger provided for heating the solvent and an after-cooler employing water cooling.

3. The extract solution contains approximately 90 per cent solvent and 10 per cent extract. This solution is preheated in the economizer section of the extract heater in the same manner as in the case of the refined-oil stripping system. Approximately 25 to 30 per cent of the solvent is vaporized in the economizer section, the remainder being vaporized with hot recirculated extract oil in the extract-stripping tower. Extract accumulation is charged from heater to open-steam furfural-stripping column as in the case of the refined oil; thence it is passed through exchangers to storage.
4. Vapors from the refined-oil stripper tower and extract-stripper tower are combined, and flow through a vapor-heat exchanger, condenser, and the water cooler to the accumulator drum. The vacuum

TABLE 3—FURFURAL REFINING OF LUBRICATING STOCKS FROM VARIOUS SOURCES

Oils and source—	Lubricating distillate								
	Van Zandt crude				Pennsylvania crude				East Texas crude
Amt. of furfural used, % of charge—	Charge	Raffinate 200% no acid	Extract	Dewaxed refined oil 5 lbs. per bbl. acid	Charge	Raffinate 300%	Extract	Dewaxed refined oil, no acid	Charge	Raffinate 200% (batch) dewaxed and treated‡ 5 lbs. per bbl. acid	Extract
Yield, per cent by volume (solvent refining)	....	78.5	21.5	....	....	76 3	23.3	....	....	†75.7	24.3
Gravity, °A.P.I.	22.3	26 6	7.6	24.4	29 3	31.0	18 3	29.5	23.7	26 4	8 9
Flashpoint, °F.	475	495	475	480	395	380	395	420	505	475	470
Firepoint, °F.	560	565	565	555	450	425	450	460	575	565	575
Viscosity at 100° F., Saybolt Universal	670	440	*14,000	500	275	270	970	375	910	833	*37,000
Viscosity at 130° F., Saybolt Universal	280	205	2,807	230	142	141	353	180	372	334	*6,000
Viscosity at 210° F., Saybolt Universal	68	60	180	63	53	54	71	58	82	76	274
Pourpoint, °F.	115	110	60	—10	80	90	70	+10	110	5	65
Carbon residue, per cent	0 58	0 18	3 3	0.08	0.57	0 27	3.21	0 23	1.14	0.18	6.35
Viscosity index†	81 waxy	95 waxy	—163	93.5	110 5 waxy	118.5 waxy	45	102 5	89 waxy	82	....

Oils and source—	Residuum—Santa Fe crude			Residuum—Pennsylvania crude			Residuum—Gulf Coast crude		
Amount of furfural used, % of charge—	Charge	Raffinate 400% (batch) acid-treated 20 lbs. per bbl.	Extract	Charge	Raffinate 400% (batch) no acid	Extract	Charge	Raffinate 400% (batch) acid-treated 20 lbs. per bbl.	Extract
Yield, per cent by volume (solvent refining)	....	†46 8	53 2	....	76.7	22.5	....	†49.7	50 3
Gravity, °A.P.I.	17.1	27 5	10.8	27 1	29.3	20 7	17.1	23.1	13 7
Flashpoint, °F.	405	435	415	465	470	435	425	430	400
Firepoint, °F.	470	490	475	530	545	490	495	505	470
Viscosity at 100° F., Saybolt Universal	3,780	460	*25,000	1,025	925	1,300	6,800	*2,200	*11,000
Viscosity at 130° F., Saybolt Universal	1,140	218	*4,980	412	405	485	1,705	749	2,240
Viscosity at 210° F., Saybolt Universal	139	64	297	93	95	90	165	115	170
Pourpoint, °F.	80	105	95	35	90	70	25	0	40
Carbon residue, per cent	8 05	0 72	11 57	1.92	0.97	4 55	3.40	1 02	4 22
Sligh No.	....	0 6	1,256	18 0	0 80	300	....	....	....
Viscosity index†	44	106	—21	99 waxy	109 waxy	70	+3	64.5	—80

*Extrapolated viscosity. †Dean and Davis viscosity index corrected to 0 A.S.T.M. pourtest[23]. ‡Acid-treating losses not included in above yields. All extractions carried out in single-batch operation. Solvents applied on volume basis.

pump takes suction on the top of the accumulator drum, and the discharge of the vaccuum pump is exhausted through an after-cooler for the condensation and recovery of the remaining traces of furfural. The solvent in the accumulator drum may be returned to solvent storage or it may again be employed directly in charging the extraction tower, thereby keeping a small volume of solvent in circulation and affording greater overall protection to the solvent.

Flue gas, containing less than 6 per cent oxygen, is employed for the protection of the solvent in storage against oxidation.

Cost of Installation

While it is recognized that each refiner who may consider the installation of solvent-refining equipment may have part of the facilities available for furfural refining, it is estimated that the gross expenditure for the installation of solvent-refining equipment will average approximately $200 per barrel of daily charge capacity.

Much obsolete refinery equipment can be employed in the design of a solvent-refining plant, as no special provision must be made for carrying high pressures and no precautions are necessary to guard against corrosion of equipment on account of solvent decomposition. No refrigeration facilities are required for chilling either oil or solvent or maintaining solutions at a low temperature. Exhaust steam may be used in the plant for maintenance of temperature, and sufficient heat is recoverable from the stripped oils to maintain solvent and oil at the proper operating temperatures.

Cost of Operations

Costs have been estimated for the processing of Mid-Continent distillate lubricating stocks using 200 per cent, by volume, of furfural in a counterflow system at 200° F. Obviously, the cost of operation in solvent refining is a function of the amount of oil processed, and the unit cost will be lower in the large installations. The distribution of the costs for the operation of a plant to process 750 bbls. per day of a Mid-Continent distillate oil with 200 per cent furfural, by volume, is presented in Table 4.

TABLE 4
(Per 42-gallon barrel)

Operating labor	$0 0527
Operating materials	0 0053
Repairs	0.0130
Fuel, steam, power, and water	0 1210
Pumping and storing	0.0694
Solvent loss (0.2% of total solvent used)	0.1575
Depreciation, insurance, and taxes	0 0938
Total	$0 5127

The above figures are considered a very conservative estimate of solvent-refining costs when employing furfural in a plant of the size indicated. It is anticipated that solvent losses may be reduced considerably below the estimate of 0.2 per cent by volume. The high figure for fuel, steam, power, and water does not allow for heat exchange provided for in the commercial installation.

Solvent Refining for Viscosity Indices of 100 or Above

Reference to Figures 1 and 2 makes it apparent that a viscosity index of 100 or higher may be obtained in refining Mid-Continent oil by increasing the amount of solvent used, and by sacrificing yield of finished oil. The motor tests presented in this article demonstrate that a furfural-refined oil having a viscosity index of 80 to 90 is a highly satisfactory oil from the standpoint of motor performance; and it is evident that oils in the range of S.A.E. 30 to S.A.E. 60, inclusive, when furfural-refined to a viscosity index of approximately 90, are extremely well-balanced oils with excellent service characteristics, comparing favorably with other premium oils now on the American market.

It is felt that attempts to solvent-refine for viscosity indices in excess of about 90, even on the low viscosity oils, will result in improvements which are more apparent than real and which are not warranted by the additional cost of refining. In this connection, it must be remembered that for an oil in the range of S.A.E. 10 and 20, an error in the determination of viscosity at 100° F. of one Saybolt second involves an error of one-half to one point in viscosity index. An error of one second at 210° F. on the same oil makes a difference of 10 points in viscosity index. Thus, precision of the viscosity determination as carried out in ordinary refinery practice permits only a similar degree of accuracy in the viscosity-index determination.

It is believed, therefore, that solvent refining should aim primarily at quality in the finished product rather than at extremes in the viscosity index.

For example, in counter-current solvent refining with furfural, a Mid-Continent lubricating stock was dewaxed with benzol and acetone and solvent-refined with 400 per cent of the solvent, by volume, in a counterflow system. The product showed as in Table 5:

TABLE 5

Gravity, °A.P.I.	28.8
Flashpoint, °F.	480
Firepoint, °F.	560
Viscosity at 100° F., Saybolt Universal	535
Viscosity at 130° F., Saybolt Universal	243
Viscosity at 210° F., Saybolt Universal	66.5
Color, Lovibond (6-in. cell)	25
Pourpoint, °F.	0
Carbon residue, per cent	0.056
Sulphur, per cent	0.19
Sligh No.	1.4
Viscosity index	100

Yields are illustrated in Figure 1.

Manufacture of Special Oils

Furfural refining has been found to be specially effective in the refining of oils having special and, more or less, rigid specifications. It is known that furfural refining is an excellent starting point in the manufacture of white oils and other highly-refined products. Similarly, refrigerator oils have been prepared from both paraffinic and Coastal sources which pass the sulphur-dioxide absorption test of less than 20 per cent sulphur dioxide, by volume, absorbed at 60° C.

Furfural refining is an excellent starting point for the manufacture of turbine oils. In this case it is particularly important that sludge-forming materials be completely removed in the refining process and that good demulsibility be obtained on the finished product. Table 6 illustrates the tests of turbine oils and refrigerator oils manufactured by solvent refining with furfural.

Mechnical Testing

Livingstone and Gruse,[22] 1929, found that the Conradson carbon-residue value on paraffin-base lubricants was indicative of the results to be expected in carbon deposition in poppet-valve motors. Page, Buchler, and Digge[17] mentioned a parallelism between improvement in viscosity index and oxidation resistance for a given oil upon solvent refining.

Table 7 is a record of the averages of a large number of mechanical tests conducted to determine the comparative behavior of furfural-refined Mid-Continent oils and lubricating oils now being marketed which are characterized by high viscosity indices. Average tests on the original oils are shown in this tabulation.

High-Speed Automotive Tests

High-speed automotive tests were conducted for the purpose of comparing the behavior of furfural-refined oil with other high-viscosity-index oils.

Six cars were used in this test, and these cars were operated at an average speed of 67 miles per hour for seven hours; after which tests the oils were drained from the crankcase, the crankcase thoroughly washed with solvent, and the sludge separated by centrifuging. The engine after each test was taken down and the carbon deposit scraped off and carefully weighed.

Table 8 presents tests on oils used in this comparison, and presents the comparative motor-oil consumption, fuel consumption, sludge formation, and carbon deposition on the various oils.

It is noted that the furfural-refined oil is superior to all of the other oils from the standpoint of carbon deposit; it is substantially equal from the standpoint of sludge formation. The precision of the mechanical testing is considered to be mechanical testing is considered to be within approximately 5 per cent on motor-oil consumption figures and probably more accurate in the carbon and sludge determination.

Attention is called to the fact that the furfural-refined Mid-Continent oil was refined only to a viscosity index of 80. This drastic motor test does demonstrate, however, that the furfural-refined oil is a very well-balanced oil in all of its performance characteristics, and gives further evidence that viscosity index is not the sole criterion of quality.

TABLE 6—TESTS ON REFRIGERATOR OILS AND TURBINE OILS, MANUFACTURED BY FURFURAL EXTRACTION AND ACID TREATMENT

	Refrigerator oil from coastal distillate	Turbine oil from Mid-Cont. distillate
Gravity, °A.P.I.	28.5	29.3
Flashpoint, °F.	385	395
Firepoint, °F.	440	450
Viscosity at 100° F., Saybolt Universal	190	192
Viscosity at 210° F., Saybolt Universal	45	46
Color—Lovibond	S.G.	14 (18-in. cell)
Pourpoint, °F.	—20	0
Carbon residue, per cent	0	0.03
Sligh No.	3.5	4.8
Viscosity index	81	94
Sulphur dioxide absorbed at 140° F.	18.3	.....
Neutralization No.	0.01	0.04
Demulsibility	1,620	1,620
Acid Treatment		
Navy emulsion: Water	.....	40-40-0-2 min.
Brine	.....	40-40-0-1 min.
Caustic	.....	40-40-0-7 min.
Steam-emulsion No.	.....	30

TABLE 7—COMPARATIVE TESTS AND ENGINE PERFORMANCE OF VARIOUS GRADES HIGH-VISCOSITY-INDEX MOTOR OILS, S.A.E. 40

Speed of engine—900 r.p.m. Jacket temperature—210° F.
Oil temperature—250° F. Full load, open throttle

	Furfural refined -200 per cent counterflow Mid-Continent	Oil No. 1	Oil No. 2	Oil No. 3	Oil No. 4
Gravity, °A.P.I.	26.6	27.3	30.7	24.9	28.3
Flashpoint, °F. (Cleveland open cup)	480	*465	435	450	465
Firepoint, °F. (Cleveland open cup)	560	535	490	505	520
Viscosity at 100 °F., Saybolt Universal	675	630	555	640	600
Viscosity at 210° F., Saybolt Universal	69.5	69	67.5	67 5	68.5
Pourpoint, °F.	0	+10	—30	+20	+10
Color, Lovibond	*225	†4¼	‡100	§40	‡150
Sligh No.	2.6	1.7	2.8	2.8	4 4
Viscosity index	85.5	91.5	99.5	83.5	94
Carbon residue, per cent	0.19	0.35	0.07	0.41	0.08
Total sludge from crankcase, grams	12.07	11.98	10.94	19.99	11.73
Total carbon deposit, grams	6.14	8.21	7.15	8.91	8.66

*Six-inch cell. †Tag-Robinson. ‡Six-inch cell. §One-half inch cell. ‖Six-inch cell.

TABLE 8—HIGH-SPEED AUTOMOTIVE TESTS FURFURAL-REFINED HIGH-VISCOSITY-INDEX LUBRICATING OILS, S.A.E. 50

	Mid-Continent furfural-refined oil 200 per cent counterflow	Oil No. 5	Oil No. 6
Gravity, °A.P.I.	26.1	28.2	27.8
Flashpoint, °F.	515	460	455
Firepoint, °F.	600	520	530
Viscosity at 100° F., Saybolt Universal	1,002	649	654
Viscosity at 130° F., Saybolt Universal	395	286	285
Viscosity at 210° F., Saybolt Universal	82	74	73
Pourpoint, °F.	—5	+20	+15
Color, Lovibond	*50	†¾	‡¾
Carbon residue, per cent	0.25	0.83	0.73
Sligh No.	1.6	4.3	4 4
Viscosity index	80	+100	99

*One-half inch cell. †Tag-Robinson. ‡Tag-Robinson.

MOTOR TESTS

Motor oil, miles per gallon	365	354	328
Fuel, miles per gallon	11.9	11.9	11.9
Speed average	67	67	67
Duration, hours	7	7	7
Sludge, grams	15.1	15.7	16.8
Carbon deposit, grams	8.9	12.9	13.1
No. of cars	6	6	6

Conclusions

After a prolonged investigation, involving numerous solvents, furfural has been selected as meeting the requirements of the most desirable selective refining solvent.

The factors which determine the selection of furfural as a refining solvent for lubricating oils are as follows:

1. Furfural is manufactured from agricultural wastes by a relatively simple process, and is available in large quantities at a reasonable cost.

2. Furfural can be applied even to the most viscous or waxy oils in a single counterflow tower due to its high temperature of application of 200° to 250° F. Furfural is extremely selective, and has a very low solubility for the desirable components of a lubricating stock—resulting in high yields of refined oil.

3. Furfural does not react with the oil under the conditions encountered in the extraction or solvent-recovery operations.

4. A greater range of temperature of application is possible with furfural than with most solvents.

5. Furfural is nontoxic, and requires no more handling precautions than does kerosene.

6. Furfural has been demonstrated to be adaptable to both distillate and residual oils from Mid-Continent, Coastal, Pennsylvania, and California crudes.

By confirmatory mechanical tests furfural-refined oils have been demonstrated to be well-balanced high-grade lubricating oils capable of resisting oxidation, sludge formation, carbon deposition, and extreme viscosity-temperature variations.

Cost of a furfural-refining plant will average approximately $200 per 42-gallon barrel daily capacity. Cost of solvent-refining operations, including fixed and overhead charges, will approximate 51 cents per 42-gallon barrel of charge oil.

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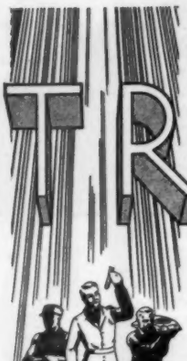

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Auto Engineers Can Help Themselves by Helping Refiners Anticipate Car Needs

By A. LUDLOW CLAYDEN
Sun Oil Co.*

Shortly after the end of the war it began to become obvious that the development of the gasoline engine was being restrained by lack of fuel suitable for high compression. More recently we have seen a similar situation with respect to lubricants; and we are probably now only at the beginning of both these things. The past 10 years have seen the development of a co-operative spirit. The two industries, oil and automotive, have a common customer. To satisfy that customer, automobiles and petroleum products must "fit" each other, and the individual freedom of action of each of the two partners is very limited. The first general perception of this fundamental fact led to the reation of the Co-operative Fuel Research Committee. The work of that body has been slow, in some ways clumsy and inefficient; but whatever criticism of detail may be made, the C.F.R. can justly claim large credit for bringing about a profound change in the relative attitude of the two industries. Automobile and petroleum technical men now know each other, understand each other, and really do try to help each other. An honest effort at co-operation has displaced the former attitude of mutual suspicion and distrust.

Jointly Responsible

But the technical men are only a part of either industry. They are the basic part no doubt—no product can be marketed until it is manufactured—but with all due respect to Emerson, paths are not worn to the doors of superlative mousetrap makers unless there are guides to point the road. The salesman and the advertising writer render a service to the customer at least as great as to the manufacturer. It is in this great merchandising field that the significance of the oil-auto partnership remains yet to be realized.

Now it is my task to regard this from the viewpoint of one partner. I shall not pause to criticize the merchandising division of my own industry. I shall resist the very strong temptation to hand back to that division some of the responsibilities it has unjustly placed upon the groaning backs of the technologists. My criticism must be confined to the sales side of the automobile industry, and I doubt not that the latter can readily respond by prodding the soft spots of the oil salesman.

Automobile design is dictated by the sales executives of the manufacturers, and there are two sorts of dictation. When something new, like four-wheel brakes or balloon tires, is developed by engineers, it usually lies dormant for years. Finally, one sales executive visualizes a sales campaign involving the novelty. Then comes the deluge; for every other automobile maker must follow suit. Whether he believes in the device or not, whether his engineers are ready or not, makes but little difference. The other sort of sales pressure is not to demand any particular feature of design, but to insist on more power, greater quietness, easier steering, or something of that order. Between the two the automobile engineer has little opportunity to develop improvements with the thoroughness which he would like.

Now, of course, not all of these things have any direct recoil upon the oil industry, but we have recently had a very fine example of the first sort in the case of free wheeling. When introduced by, I think, Studebaker, this age-old device was rushed onto almost every car in a matter of months. Engineers were compelled to use devices of which they did not approve. To protect themselves against anticipated trouble, laboratory tests were rushed through and a hasty conclusion reached that special lubricants would be needed. That such oils were not generally available did not in any way restrain the automobile manufacturers, who called upon the oil industry to shoulder the responsibility for the poor design of an ill-considered mechanism. The oil industry came to the rescue. At a very considerable expense in a year of poor business it made available, all over the world, a special series of oils; only to discover a few months later that there was no demand for them, no necessity for them, and no possible prospect of profitably disposing of them. It had been made the goat for the automobile salesman, and this fact is not going to be forgotten in a hurry.

Cheap Cars

Typically of the other sort of development, the sales division of the automobile industry has called for more and more power from cheaper and cheaper engines. This has practically compelled engineers progressively to raise compression pressures, while the cheapness side of demand has restrained them from incorporating detail improvements in engine construction which really should accompany high compression. A poorly-designed high-compression engine needs fuel of a considerably higher antidetonating quality than does a perfectly-designed motor of equivalent power output. The result is that many of the present models of popular cars are on the ragged edge of performance with the average gasoline available in sections where the octane average is high. These cars can only be made to perform smoothly in low-octane territories by so changing their adjustment that their power possibilities are not realized. The oil industry is making every effort to catch up. This is costing money, and the gasoline market will not be enlarged, nor will the price obtainable be increased, as a result of raising the octane average for the whole United States. Meanwhile the automobile manufacturer is not getting credit for his engine improvement, because it is only in special territories or with special fuels that it can be realized.

Mutual Development

Without question this introduces far the greatest thing the automobile industry can do for the oil industry right now. It can get together with the oil industry and establish a plan for mutual development of fuels and engines. Of course, there will always be good and poor automobiles and good and poor gasolines; but, with the latter, the difference between best and worst—at least in detonation—is shrinking, and will shrink still more. This general improvement is what the automobile industry needs most. If it could be agreed that no popular cars would be built before 1936 with a C.F.R. octane requirement in excess of an agreed figure, this would permit the oil industry to give its attention to evening up the octane-rating average over the country, and also would allow more attention to be given to other features of gasoline. For instance, the power produced by an engine depends absolutely upon the amount of air that it can pump. If gasoline were much more volatile, larger carbureters and manifolds could be used; there would be better distribution of fuel between different cylinders, and the volumetric efficiency of the engine would be considerably enhanced.

Let me ask here and now, is the automobile industry planning to change the design of intake systems so that only gasoline more volatile than the present average will be essential? If so, how fast will such changes be made, and what distillation curve may we expect to be asked for in 1936?

Probably the oil industry would prefer to work on volatility just now, because the possibilities for improvement in that respect appear much greater than do possibilities of any great increase in octane rating. Certainly, we do not want

*Before A.P.I., Chicago, October 26.

to make gasoline of better volatility if no advantage it to be taken thereof. But if we admit the impossibility of standing still—and most men do admit it—then let us get together and decide to work along mutual lines so that fuels and engines will keep in co-ordination.

Remember this cannot be done entirely by the type of men who make up the C.F.R. It can only be done if the merchandising branches of both industries realize both the possibilities and the limitations. It is the executives of the twin industries that must make the agreement if any such agreement is made. It is men like those composing the boards of directors of this Institute and of the Automobile Chamber of Commerce who alone can speak for their respective industries.

Extreme-Pressure-Lubricant

I have given an outstanding example of how not to do things by citing the history of free wheeling. To show that co-operation is possible, and is in fact easy, we have only to look at the extreme-pressure-lubricant situation. This has been handled absolutely as it should be. Automobile makers want to use gearing that will take advantage of new steels. In passenger cars this would permit a saving of weight and cost. In large trucks and buses it would permit an increase in engine power. Owing to space limitations, axle gears can only be a certain maximum size; and this is now the neck of the bottle in truck design. Research financed by both industries is being conducted, and great progress has been made in a short time. This research shows how far the oil industry may reasonably be expected to go; and, therefore, tells the automobile engineer what are his limitations. Meanwhile the automobile industry has refrained from forcing the issue. Undoubtedly this situation was helped by the calamitous experience of one automobile manufacturer who was a little over sanguine in putting out a new model in fairly large production; but the co-operative movement was well under way before this happened.

Before putting out a new model with new features, the merchandising division of an automobile plant should take pains to be assured that the performance of the car does not depend upon the use of special fuels or special lubricants. Napoleon sent an army into Russia expecting it to be able to pick up its food on the road. We all know what happened to that army! This lesson needs to be impressed upon automobile sales executives.

If we are to interest these men, we must appeal to their self-interest. The oil industry does not ask for co-operation from its partner on any other basis. We are both seeking to satisfy the same customer, and we can do it if we work together. If the automobile salesman insists on complete freedom of action and refuses to co-operate, then every so often it is bound to get both industries into trouble with the ultimate consumer. Remember that automobile service departments have never been in the least hesitant in passing the buck by blaming oil products instead of admitting faulty mechanism. The oil industry has shown extraordinary patience in the face of this injustice. None the less, the most spineless of worms does turn occasionally; and, if the oil industry did decide to turn, it would be just too bad for the particular automobile it turned upon.

All the foregoing deals with obvious, simple facts; but the more obvious and the simpler facts are, the harder is it to get them realized. Hence, I make no excuse for verbosity or repetition. However, there are detail matters demanding joint attention which technical men can work upon without having to wait for a change in the attitude of their sales divisions. These things are much more complicated and so are much more likely to be given attention.

Lighter Oils

Automobile engineers want lighter engine oils used to give easier starting and to reduce engine friction. The automobile user wants minimum oil consumption. The oil industry sells the customer oil mileage and, therefore, heavy oil. Instruction books, charts, and light-oil propaganda are all useless waste of time and money until engines are built so that they will consume no more light than heavy oil. That the motorist should care nothing about gasoline economy and yet insist upon extreme parsimony with oil is one of those curious psychological phenomena that defy explanation. Yet here is a perfect example of the absolute necessity of satisfying the consumer. Oil consumption today is almost entirely a matter of oil viscosity; so it is up to engine designers, and to them alone, to solve this problem.

Here let me emphasize something of great importance which applies in many cases. Automobile engineers almost universally insist upon thinking in terms of new cars. The oil supplier has to think of cars in the 20,000-40,000-mile condition.

An excellent example of what this leads to is the increasing tendency to specify gear oils for chassis lubrication in automobile instruction books. Now gear oils may be excellent in new cars, but greases will last twice as long, or more, in old cars. This means that the wise greasing station pays no attention to the instruction book, since the man who does this loses his customers to the man who does not.

Asks for Too Many Products

Similarly automobile men seem to have an amazing ignorance of how lubrication service is given. We now have seven S.A.E. motor oils, four S.A.E. transmission oils, three free-wheeling oils; and it has recently been suggested that we add nine greases. Note that this totals 23 different products. These are supposed to be provided so that an automobile engineer can select and recommend whatever he wants of these 23 for his particular model. In actual fact, the car is going to be taken for service to stations where there is one grease, one transmission oil, and perhaps two motor oils. So in the words of the immortal Goldburg that list of 23 "doesn't mean anything." The oil salesman who tried to stock a dealer with 23 lubricants would assuredly get "skidoo" for an answer.

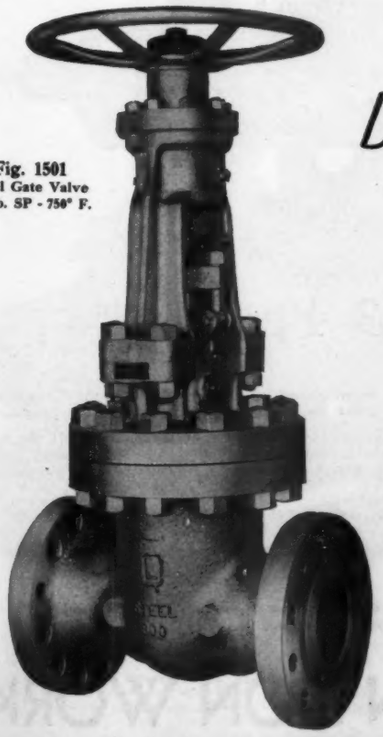
The fewer different products called for, the greater the probability of the right one being used. With 23 choices the chances are about 12 to 1 against the automobile man. There is absolutely nothing the oil industry can do about this. It has always been willing to make anything asked for, but it cannot force an unwanted article down the throat of an unwilling customer.

To be specific, there is no need for more than three motor oils if engine design is co-ordinated. There is no need for more than one viscosity range for transmission oil, and no need for more than one grease, with the proviso that the transmission oil and the grease might be wanted in summer and winter types. I do not mean that such a limited series of S.A.E. classification would suffice right now; although it represents the range used by at least 90 per cent of service stations. I mean it could be made to suffice if automobile engineers would consider simplicity of service as an outstanding necessity of good design. Let us at least try to set up simplified lubrication as an ideal to be striven for.

Complete Draining

While on the topic of what engineers can do, there is a petty detail almost universally neglected which would be of great assistance in getting cars properly serviced. The complete removal of old lubricant from engines, transmissions, and differentials ought always to be possible. Actually these parts should be so designed that solvents can be used for cleansing

(Continued on Page 88)



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Good Mud Fluid and Proper Control Devices Aid in the Safe Drilling of Rotary Wells

By E. P. HUBBARD
Gulf Production Co., Houston, Tex.*

The control of high-pressure drilling wells in the Gulf Coast is today receiving deserved attention from every careful operator. This problem is becoming increasingly important because of the increasing depths to which wells are being drilled, with proportionally higher formation pressures and probable increase in the number of gas-bearing formations encountered. It is obvious that high-quality material must be used in properly designed equipment for the control of these high-pressure wells. This phase of the subject will not be discussed in this paper. Instead, it is intended to present the methods used and the practical experiences encountered daily by the active operators in the Gulf Coast.

Sources of Formation Pressures

In the Gulf Coast by far the greater portion of fields derive their formation pressure from a hydrostatic head whose source elevation is quite unlikely to be over a very few hundred feet higher than the surface at the well. Table 1 shows that there is no very marked difference between the subsurface pressures observed in a number of producing wells in various fields and an equivalent head of pure water. The designation of one well over another of the same depth as a "high-pressure well" generally arises over well-head pressures during production, and is generally the result of a difference in gas-oil ratio or fluid level. The dominant factor controlling formation pressure is depth.

The commonly accepted method of overcoming the formation pressures encountered in drilling is by the use of a circulating drilling mud.

As can be noted from Table 1, there is a safe margin in the difference between formation pressures and a column of drilling fluid weighing 9½ pounds per gallon, which is the weight of mud most commonly used in normal drilling operations.

TABLE 1—A COMPARISON OF OBSERVED FORMATION PRESSURES WITH AN EQUIVALENT HEAD OF VARIOUS FLUIDS

Well—	Depth at which pressure observed (feet)	Subsurface pressure (lb. per sq. in.)	Hydrostatic head lb. per sq. in. at same depth	
			Water	9½ lb. per gal. of mud
Thompsons				
F. I. Booth A-1	5,156	2,291	2,240	2,540
T. R. Booth 1	5,185	2,322	2,250	2,555
A. P. George 3	5,225	2,197	2,270	2,575
Lockwood and Sharp A-3	5,164	2,220	2,242	2,546
Myers 3	5,283	2,285	2,292	2,605
Conroe				
Cartwright A-1	5,103	2,228	2,218	2,515
Dobbins 1	5,099	1,983	2,217	2,515
South Texas Development 2	5,030	2,278	2,185	2,480
South Texas Development 5	5,158	2,207	2,197	2,546
South Texas Development 8	5,170	1,902	2,246	2,546
Raccoon Bend				
Bracey A-5	3,525	532	1,530	1,740
Urban 4	3,447	596	1,490	1,700
Sugarland				
Bankers Manufacturing B-2	3,725	1,665	1,620	1,845
Bankers Manufacturing B-3	3,717	1,519	1,617	1,841
Camp 9	3,682	1,416	1,596	1,816
Nelson 11	3,556	1,459	1,530	1,759
Sugarland A-3	3,738	1,596	1,607	1,850

Common Causes of Blowouts

The lowering of the drilling fluid level in the hole and the inclusion of gas bubbles in the mud are the chief factors conducive to a blowout. It is a significant fact that a great majority of blowouts occur when coming out of the hole. In the Thompsons Field eight blowouts have been experienced, and in each case the drill pipe was being removed from the hole at the start of the trouble. Obviously, particular care should be exercised during this operation. An appreciable volume of mud is displaced by the pipe; and, when it is withdrawn from the hole the fluid level drops a proportionate amount. The openings in the bit are small; and, if the mud is very viscous, or if the pipe is withdrawn rapidly, there is insufficient time for the mud to drain from the bottom of the drill stem—and, as the joints are disconnected, the mud is drained onto the derrick floor. The clearance between the pipe and the hole is often quite small; e.g., the outside diameter of a 6⅝-inch pipe coupling is 7¾ inches, which affords only 1 1-6-inch radial clearance in a 9⅞-inch hole.

If the mud is highly viscous, it will tend to adhere to the pipe; so that as the pipe is rapidly withdrawn from the hole, a swabbing action results, and the mud is forced out of the hole.

These conditions may lower the fluid level until the hydrostatic head is insufficient to overcome the formation pressure. This will permit the infiltration of gas further reducing the effective head, and the result is inevitable. In order to

*Before annual meeting, A.P.I., Chicago. Author's title: "Control of High-Pressure Drilling Wells in the Gulf Coast."

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obviate these difficulties, it is good practice to fill up the hole after every third stand has been withdrawn, and to reestablish circulation for about 20 minutes every tenth stand, until any particular troublesome formation has been passed. In extreme cases, it may be necessary to "swivel" out of the hole from bottom to top.

Mud Control

Mud control is a highly important phase of drilling operations, and only in the past few years has the problem been given the attention it deserves. Practically every major operator has a staff of trained men devoting its time to an intensive study of this interesting work. Already many beneficial results have been achieved, and additional benefits may be expected as this study continues.

The drilling fluid has four important functions to perform: to lubricate the drill bit and drill pipe; to carry cuttings from the hole; to seal the wall of the hole; and to provide a hydrostatic head sufficient to overbalance the formation pressures encountered.

During the drilling operation the weight and quality of the mud should be watched with care. The practice of weighing with a spring scale and bucket has been found very inaccurate; but the mud hydrometer, calibrated in pounds per gallon, is more satisfactory.

Gas-cut mud is a common source of trouble in weight reduction. This generally occurs in drilling fluids of high viscosity and high rates of gelation, and is caused by the addition of lime from the formations penetrated.

If the percentage of lime in the mud is less than 5 per cent by weight, the addition of sodium tannate will counteract this effect and permit the escape of the entrained gas in the mud ditch.

The relative proportions of tannic acid and caustic required to condition any given mud are best determined by experiment. One common mixture is to add 5 per cent, by weight, of tannic acid and 3 per cent, by weight, of caustic soda to 50 gallons of water. This solution is added to the discharge of the flow line at the rate of about 1 gallon per minute. The mud is then circulated for about 1½ hours to determine whether additional treatment will be necessary. If the lime percentage is higher than 5 per cent by weight, the fluid—if possible—should be diluted with water until the concentration has been reduced. If the mud weight is dangerously low, some weighting material of nongelling property should be added with the water. Care should be exercised not to reduce the gel-forming property too much, as gelation is an important factor in maintaining a good seal in the wall of the hole. A mud of insufficient gelling property may form a thick porous wall which is easily dislodged by the rotation of the drill pipe. The finely-dispersed colloids present in fluid of the proper gel strength will cause the formation of a thin wall—of high mechanical strength—that will more effectively seal off the formation than a thick wall deficient in gelling property. This has been repeatedly demonstrated in the laboratory, and corroborated by field experience.

If a gas formation is particularly troublesome, it is often desirable to seal this formation temporarily until the oil-producing horizon has been encountered and casing has been set. This has been effectively accomplished a number of times by the use of sodium silicate and hydrochloric acid. The method use is as follows: A low-viscosity solution of sodium silicate is introduced into the drill pipe, followed by about a barrel of thin mud to separate it from the hydrochloric acid (18° Baume) which follows. This is then pumped to the bottom of the hole, and back pressure is applied by putting on the blowout preventer and choking the flow line. Due to the low viscosity of the sodium silicate, it will tend to enter any porous formation with which it comes in contact. When the hydrochloric acid contacts the sodium silicate, salicylic acid is formed—which causes cementation of the pore space. This would be applicable only in a medium or fine-grained sand. The effectiveness of this method has not conclusively been proved, but results so far indicate that it has merit.

Excessive Pressures

The foregoing discussion has dealt largely with the usual formation pressures whose magnitude is roughly proportional to the depth at which they are encountered. Occasionally, lenticular formations are encountered whose pressures materially exceed the hydrostatic head. In such cases it may be necessary to increase the weight of the mud by the addition of materials of higher density than found in ordinary drilling mud clays. The most common materials used for this purpose are compounds such as iron oxide, barium sulphates, amorphous silica, etc., which are available under various trade names. When adding these materials to mud in the hole, care should be exercised to prevent unbalancing of the fluid columns too rapidly. Since these materials are considerably heavier than the ordinary sand, shale, and clay carried in suspension, there is a greater tendency for them to precipitate. To counteract this property, the colloidal characteristics of the mud should be properly maintained. Some of the compounds include bentonites to provide for this contingency. It must be borne in mind that this increased weight of the mud reduces the capacity of the fluid to remove cuttings from the hole.

By the addition of weighting materials, the mud weight may be increased to 15 or 16 pounds per gallon; but this weight is rarely needed, and is not recommended except in extreme cases. Mud in excess of 12½ pounds per gallon is very difficult to handle, and precipitation is quite likely should circulation be interrupted. This might result in seizing the drill pipe. When drilling fluid weighing less than 12½ pounds per gallon will not suffice to overcome the pressures encountered, it is probably best to resort to a stuffing box for the drill stem and chokes on the mud outlet to control the pressure. In this case, while drilling, the mud should be reduced to normal weight in order to provide additional carrying capacity and to reduce the tendency to gas cut.

When coming out of the hole, the light mud should be displaced by heavy mud, with circulation maintained as much as possible by "swiveling" out. When going into the hole, of course, the reverse of this procedure should be employed.

In all cases where high pressure gas formations are encountered, adequate circulation should be maintained to prevent gas pocketing, and to insure a uniform distribution of properly conditioned mud.

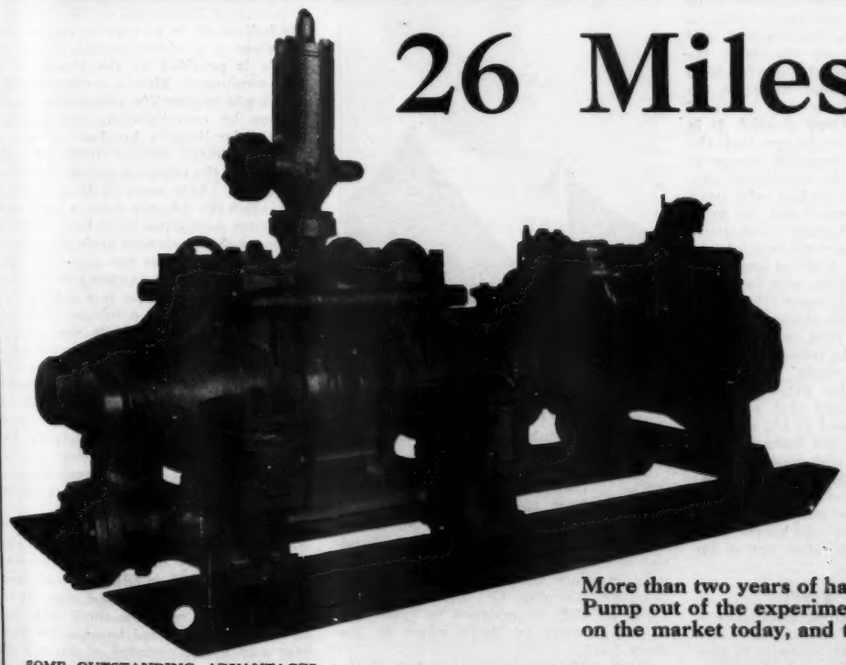
In some fields in the Gulf Coast blowouts and craters have caused a supercharging of shallow sands in contiguous areas by high-pressure gas from lower formations. This has created a special problem for offsetting wells. In some cases relief wells are drilled to drain this abnormal pressure. In other cases the operators use weighting materials to obtain extremely heavy muds to drill through and case off the troublesome strata. It can be appreciated that if two or more such sands are encountered, the casing program can become quite complicated and expensive.

Blowout Preventers

Even though the operator has observed all the ordinary precautions in drilling, there still remain the human element and unforeseen circumstances which inevitably arise; and the well might attempt to "blow out." Every careful operator drilling on either "wildcats," or where gas-producing formations are known to exist, equips his well with a blowout preventer immediately after setting surface casing.

There are two well-known types of blowout preventers in general use, and most operators equip the well with one of each type. The ram type blowout preventer has incorporated in the body a ram or piston which, upon application

26 Miles of Hole



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of pressure, forces an especially prepared packer around the drill stem. The Hosmer type blowout preventer has a body with a special type bowl mounted on the casing. An especially prepared packing assembly is latched around the drill stem and lowered into the bowl, thus sealing off between the drill stem and the casing. Of course, both types of preventers provide a means of conducting the fluid from the space between the casing and the drill pipe — where it may be controlled by suitable valves, chokes, etc. The Hosmer type preventer depends upon the weight of the drill pipe or a screw-down arrangement to apply the necessary pressure to seal off the well pressure effectively. The ram type preventer depends upon the pressure applied to pistons, or rams, for this sealing effect. The source of this pressure may be a mud pump, a boiler-fed pump or a separate water pump especially provided for this purpose. The lines from these pumps may be manifolded, and the control valves so placed as to be most accessible to the member of the crew charged with the duty of closing the preventer rams.

One of the major companies has conducted extensive tests on the amount of pressure required effectively to seal off this type of preventer; and, from the data obtained, advises that at least 350 pounds should be applied to the rams to seal off a well pressure of 1,000 pounds. Formerly, steam from the rig boilers was used for this operation; but, due to the low pressures available and to the compressible and condensible characteristics of steam, its use as a pressure agent has been discontinued.

Auxiliary hand wheels, with lazy rods extended beyond the edge of the derrick floor so as to be readily accessible, are provided for final locking of the rams in position. Because of the promptness and positiveness of its action—which can be remotely controlled—the ram type has been largely favored in this section. One manufacturer has recently developed an automatic device for applying and latching the packing assembly to the drill pipe. This device is mounted on the body of the preventer. Arms, on which the packing assembly is mounted, are forced out by application of pressure to a piston and automatically latch the pack-off around the pipe. The chief advantage lies in quickly latching the pack-off below the rotary, as opposed to the previous manual latching on the derrick floor—which requires removing the rotary bushings to lower the assembly into place.

Some operators place a back-pressure valve in the drill stem to control the pressure in such emergencies as the failure of the drill hose. This is generally located just below the Kelly; but some operators place it down the string, or even just above the drill collar. Another device frequently used is known as a "pup joint." This consists of a tool-joint pin, a nipple of sufficient length to extend from the top of the blowout preventer to a point just above the rotary, a quick-closing valve, a short nipple, and a tool-joint box. This joint is inserted between the drill pipe and Kelly, and provides a positive closing valve for emergency use.

Operations When Combating Blowouts

Time is the very essence of proper control when a blowout is threatened. In order that the drilling rig personnel may be properly trained and co-ordinated in their operations, many companies require a daily "blowout" drill by each crew after the well has reached a given depth. This drill is identical, in every respect, to the actual procedure followed when a blowout is threatened. It not only serves to train the crews but provides a check on the condition of the blowout preventer equipment. Following is an outline of the schedule of operations during a blowout, or drill:

Blowout Preventer Drill

Crew: Driller, derrick man, fireman, pipe racker—helper No. 1, boll weevil—helper No. 2.

Procedure: Let down block, and all but derrick man hook into Kelly.

1. Driller picks Kelly up out of rat hole.
2. Fireman, helpers No. 1 and No. 2 stab Kelly while derrick man comes down out of derrick.
3. Fireman closes rams on ram-type preventer.
4. Derrick man gets pack-off, and swings it to drill pipe.
5. All crew, except fireman and driller, latch pack-off.
6. Helpers No. 1 and No. 2 pull rotary bushings.
7. Driller lets pack-off down in bowl, and seals it.
(a) Derrick man starts slush pump.
8. Helpers No. 1 and No. 2 go below and lock rams.
9. Derrick man closes quick-closing valve.
10. Close off choke, if still blowing.

Note: 3-4-5 happen almost simultaneously; 6-7a happen almost simultaneously; 7-8 happen almost simultaneously; 9 is last thing done.

A brief description of a typical procedure is as follows: Let it be assumed that the crew is "coming out of the hole," and has just "set back" a stand of pipe, when one of the crew calls the driller's attention to the threat of a blowout. The driller, satisfied as to the reality of the threat, issues orders to close in the well. While the driller lets down the block, the derrick man is called down from the derrick; and the fireman, if not already on the floor, is called from the boilers. The floor crew hooks onto the Kelly; the driller pulls it out of the "rat hole," and the fireman and two helpers make the connection to the drill pipe. The fireman goes to the pressure-line manifold, and closes the ram-type preventer by applying pressure to the rams. While the fireman is performing this duty, the derrick man has reached the floor, and has carried the packing assembly to the rotary. Assisted by the two helpers, he latches it onto the drill pipe. The helpers then remove the rotary bushings from the rotary, and the driller lowers the pipe until the packing assembly is seated in the body, and the dogs latched in the retaining ring of the Hosmer type preventer. By this time, the derrick man has started up a mud pump to provide circulation, and is checking the valve on the flow-line choke to be sure that it is open. Just as soon as the helpers operate the hand wheels and lock the rams tight on the pipe, the driller should instruct the derrick man to close the quick-closing valve on the mud flow line. The choke may be closed or left open as conditions demand. It is the duty of the driller to see that the steps in the foregoing procedure are properly carried out, and he should not give the order to close the flow line valve until the rams have been locked and the packing assembly properly seated; otherwise the pressure on the preventers might be too high to permit a positive seal. The flow line choke should be open to reduce the hazard of a water hammer effect upon the closure of the quick-closing valve. A quick-closing valve is used on account of the time factor, and to reduce danger of fluid cutting which might occur if a screw-stem seating valve were used. The crews may be so trained that the complete routine is completed in 1½ minutes. As previously stated, the foregoing procedure is typical only, and some operators prefer to vary the order of the routine; e.g., certain operators close the ram-type preventer as soon as possible, on the theory that the packing will prevent any tendency of the pipe to blow out of the hole.

Inspection of Equipment

There is a possibility of misalignment between the rotary and the casing, which permits the Kelly joint to come in contact with casing nipples and the nipple between the ram type and Hosmer type preventer. Some operators so arrange that the top spacing nipple can be of the same length on all wells, and is used over and over on the bottom of the blowout preventer. This nipple may become so thin and worn that it might fail should it be subjected to high pressure. If a nipple, or other connection of small inside diameter, be used between the two blowout preventers, the same wear may be experienced — with resultant failure. Some companies weld flanges on the top of one preventer and the bottom of the other to make this connection. This flange has an inside diameter sufficient to obviate this difficulty.

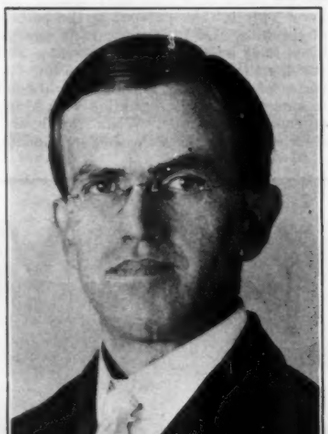
The mud lines and fittings should be replaced after a blowout, when any appreciable amount of sand is involved. There have been wells in which the first blowout had been successfully overcome only to find that the mud line had failed in a subsequent blowout on account of the thin walls resulting from sand action in the first blowout.

The business of drilling oil wells is, at best, a hazardous and expensive undertaking, and the careful operator should employ all possible means to reduce these hazards to a minimum. Good equipment, properly conditioned mud, and a well-trained personnel—alive to the situation and versed in modern methods of controlling high-pressure drilling wells—will go a long way towards affording the drilling superintendent a sound night's sleep.

Dr. A. F. Melcher Dies of Paralysis in Tulsa

Dr. A. F. Melcher, well known geophysicist of Tulsa, died in a local hospital on the morning of October 21 from complications following a stroke of paralysis suffered some weeks ago. The paralysis was caused by blood clot formed after an injury from a fall that occurred last summer when Doctor Melcher was at his father's home near Union Star, Mo.

Doctor Melcher was 50 years of age and was born in Shelby County, Illinois, and attended Central College in Missouri where he received his bachelor's degree



DR. A. F. MELCHER

in 1907 and his master's degree in 1908. He studied physics and higher mathematics at the University of Chicago but left there to take up geology at George Washington University in 1911.

Doctor Melcher spent his vacations while at George Washington University with the U. S. Bureau of Standards and joined the U. S. Geological Survey in 1913 as physical geologist and geophysicist and remained there until 1925. That year he joined the geological staff of the Marland Refining Co. at Ponca City, Okla. In 1928 he resigned to enter consulting practice in Tulsa where he has since lived.

Doctor Melcher was a member of the American Association of Petroleum Geologists, American Institute of Mining Engineers, American Association for the Advancement of Science, American Petroleum Institute, National Geographic Society and the Oklahoma Academy of Science. He is survived by his widow, a twin son and daughter, William and Miriam, 19 years of age, and another son, Lewis, 20 years old.

Funeral services were held in Tulsa with Rev. C. C. Grimes, pastor of the Boston Avenue Methodist Church officiating and the body was buried in Union Star, Mo.

Auto Engineers Can Help Refiners Anticipate Needs

(Continued from Page 85)

with certainty that they will drain and not be trapped. The fine abrasive that collects is not removed by mere lubricant draining, and in far too many cases even the lubricant cannot be completely extracted. Incidentally, I have yet to see a steering gear with any provision made for draining it, despite which fact a good many engineers recommend the use of different lubricants summer and winter.

It might be in order to suggest that the lubricants division of the S.A.E. standards committee have its name changed to lubrication division, and that it take up such matters of mechanical design. Standards of recommended practice are even more needed with respect to the design of lubrication systems than they are regarding the characteristics of lubricants.

Turning to quite another phase of the oil-auto situation discloses a probable explanation for multiplicity of existing and suggested S.A.E. lubricant classifications. This is the habit automobile manufacturers have of writing factory specifications with total disregard for those of other manufacturers. One of the largest automobile producers has recently gathered together all the different specifications for petroleum products by all its divisions. The list thus shows all the individual notions of all the chemists, engineers and production managers; and any oil man looking at it with the right mental attitude will get a good laugh. If there were added to this compilation the oil specifications of all the other large automobile plants, no mere human laughter could begin to do justice to the absurdity disclosed.

Now let me admit—as I do most freely and fully—that many excellent new lubricants have been developed because some nut of an engineer insisted on having them. I am wholeheartedly opposed to statutory limitations on the freedom of the individual, be he man or corporation; but there is a middle ground. A good example is provided by the history of oil field equipment. Here a concerted effort was made to simplify purchasing specifications by co-ordination, and in fairly short order literally hundreds of sizes of pipe and other simple units were discarded—to the complete satisfaction of all concerned. There were no laws made; in fact, since the job was done, a good many new sizes and types have been added as changing circumstances made them necessary, and at no time was any driller prevented from buying anything he wanted.

Facing us right now is a splendid opportunity to try out a scheme of co-ordination between automobile men. I refer to extreme-pressure lubricants for which specifications will soon begin to be written for the direct supply of automobile factories. If the old ways are followed, the refiner will be faced with the necessity of combining the same endpoint base in a dozen different proportions with 20 different straight oils, whereas two proportions in three oils would meet all conceivable requirements.

I often wonder what would happen if oil companies wrote specifications for the automobiles they buy. The manufacturer who wants a plus or minus of one second on a hundred vis. oil—and they do exist—might get rather a shock if he had an automobile rejected because the wheel base was a thirty-second of an inch off. I can think of nothing more delightful than being given a free hand to set up automobile specifications conforming in principle with the oil specifications now generally in use by the automobile industry. Alas, that day will never come; but I believe we may look forward with confidence to the time when I can forget my present urge—to the time when the automobile industry will have abandoned the pious hope of finding 23 lubricants in every greasing station—to the time when their factory specifications will no longer excite my ribaldry.

Survey of Advances Made in the Pipe Line Systems

(Continued from Page 30)

was believed to occur in these lines. Five or six split joints on a trunk line system each year is not unusual, but since that paper was issued and the matter explained to the operating men, this trouble has been eliminated. It is the practice now of the chief oil dispatcher of our company to keep the station crews thoroughly informed as to the amount of oil which has to be moved into the line before the drainage is filled, and the by-pass valve is watched carefully until the drainage has been completely filled and the full pressure developed. The usual practice is always to replace a joint of pipe in which the lapweld has failed. A large loss of oil usually occurs if the pipe is in the low part of a drainage area. The procedure for such a repair in the past and at present is the same as described for replacing a section of pipe on account of a pulled coupling.

Cracked Welds

23. Occasionally a failure occurs in a girth weld. The only practical repair is to drain the line, cut out the weld and

Fig. 13

enough pipe to set in a piece of pipe which will be welded in the line by the oxyacetylene method.

Records Must be Kept

24. A successful maintenance program on a large pipe line system depends on the field men reporting all leaks and breaks as well as inspections which are made from time to time. Such reports must be made in some systematic way and it is imperative that suitable forms be provided for reporting to the general office, where a careful record is kept, usually in the engineering department. The reports are usually made by the connection foreman through his district foreman or superintendent, and it is important that the field men be trained in the proper use of the forms which are supplied them. A complicated and expensive system of making reports and keeping records can easily be established and diligence must be observed to keep records within practical limits. The scope of this paper will not permit one to go into the details of the forms and records.

Mile Post Markers

25. Accurate reference points along the pipe line, especially the trunk lines, must be provided to enable the field men to report definitely the locations of leaks, breaks, repairs and reconditioning jobs. Mile posts are set on most pipe lines. Such a marker, used by our company, is shown in Figure No. 7. It has been learned by experience that it is not only inconvenient but too much time is required by the field men to tie in the locations with mile posts, and this condition encourages the men to estimate rather than measure the distance. To meet this condition, our company has designed a brass tag 1½ inches wide and 3½ inches long, stamped with the company name. These tags are nailed at a certain place on a prescribed fence post where the lines cross each property fence. The inventory distance on the line is stamped on the tag with a steel stencil, and the tag is nailed to the fence post by the civil engineers when they make their measurements. It is necessary that each person concerned in the field be advised as to the use of the tag and a circular letter was sent to superintendents, connection foremen and linewalkers. The use of the inventory tag on the property fence posts has aided materially in obtaining accurate records from the field.

Field Observations

26. Many oil leaks from corrosion can be prevented if the field men especially the linewalkers, are trained in a practical way to observe and report conditions which may result in the corrosion of the lines. In our company, the field men, from the superintendents to the linewalkers, are being coached concerning the practical corrosion problems and are being trained to observe conditions along the line. Our linewalkers have been provided with an "A-B-C" instruction paper on corrosion of pipe lines and told in his own language the miscellaneous causes of corrosion along a pipe line. Each linewalker is provided with a note book to record his observations and report them to his connection foreman, and these two men are being made responsible for conditions along their section of the line. This plan is bringing about valuable results.

Inspection of Lines

27. An important part of a maintenance program for oil pipe lines is an inspection of the lines at places where the records, practical observations and experience point to corrosive conditions.

During the past two years our company has made a thorough inspection of the trunk lines where they cross water courses, streams and creeks, also in the banks of the creeks. As a result of these inspections, a considerable amount of pipe in such places has been replaced already; and others will be changed according to a schedule. This procedure has effected real savings and effected better operating conditions. Such a program is warranted because repair jobs in such places can be done only under favorable conditions; otherwise, the jobs might be expensive and, in addition, a large loss of oil and damage might occur. An emergency repair job done at such places during unfavorable conditions may result in a long shut down.

Our records and experience indicate that corrosion of the lines can be expected under the following conditions:

Outline of Some Known Causes of Corrosion of Oil Pipe Lines

(A) Old oil leaks.

(B) Natural soil corrosion:
- (a) Alkali soils.
- (b) Tight soils that hold moisture such as clays and gumbo.
- (c) Marsh and swamp land.
- (d) Drainage or water courses and ditches.
- (e) Fills or dumps of mixed soils.
- (f) Creeks and creek beds.
- (g) Ponds.
- (h) Any condition which subjects line to alternate wetting and drying.

(C) Oil or gas field refuse:
- (a) Salt water areas.
- (b) B.s. ponds.
- (c) Slush pits.

(D) Acids:
- (a) Cinder fills.
- (b) Refinery waste.
- (c) Barnyard drainage.
- (d) Hog pen drainage.
- (e) Sewerage disposal.

Fig. 14

- (f) Mine and smelter drains or dumps.
- (g) Dumps or rubbish.

(E) Decaying vegetation:
- (a) Wood thrown in pipe line ditch.
- (b) Tree stumps and roots in pipe line ditch.
- (c) Any foreign material in ditch.
- (d) Old straw or hay stacks.
- (e) Manure piles.

(F) Artificial:
- (a) Road crossings and road ditches.
- (b) Railroad rights of way and barrow pits.

(G) Electrolytic:

Stray electrical currents from electric railroads or from other pipe lines may cause severe corrosion.

Such a list has been given the field men to guide them in their observations.

Oil Leaks Cause Corrosion

28. Oil leaks result in corrosion and a high percentage of pipe line repairs. If a leak occurs in a soil of tight texture and the drainage is poor, a serious corrosion of the line will occur within a period of four to seven years. An example of corrosion from oil leaks is shown in Figure No. 8. Unfortunately many small leaks from couplings never come to the surface of the ground and there is no way of anticipating the corrosion from this class of leak; however, it is the practice of most pipe line companies to remove oil-soaked ground from the ditch and replace it with uncontaminated soil. The line in areas where old oil leaks have occurred in the past is inspected for corrosion. Corrosion from oil leaks accounts for an appreciable part of the maintenance work on the thread and coupling lines.

Additional Precautions for Old Lines

29. Often there are circumstances which will permit only the necessary expense to make emergency repairs on certain lines—an example would be, possibly 30 miles of 6 or 8-inch lateral line, which has been in service 14 years and may be continued in active service for a few years, but the exact status of the line on account of the supply of oil for it is unknown. Only a limited number of repairs can be made on such a line. To meet a condition of this kind, our company has installed plug valves on each end of the line and a sensitive orifice meter on the receiving end of the line. The plug cocks have been installed to hold a limited test pressure which will be put on the line once every two or three months. It is believed that if a test pressure of 201 to 300 pounds for the whole line holds for a short time, the line can be operated without pit leaks for a reasonable period of time. Our experience with orifice meters indicates that although a small leak cannot be measured, it can be indicated on the chart of the differential pressure gauge. It is planned to use the orifice meter on the receiving end of the line for this purpose. The results of this work are not available yet for publication.

The Problem of Draining Lines

30. One of the most perplexing problems in the maintenance schedule for oil pipe lines is the drainage of oil for the replacement of pipe. For this reason, pipe replacements were not made unless it was absolutely necessary. The present practice of patching lines can be attributed largely to this problem, along with the fact that the lines could not be spared.

In the case of single lines, and for multiple systems also, it has been necessary to excavate a large earthen pit along the right of way, or to provide a dam in some low part of the right of way to store the oil which is drained from the lines. A large amount of the oil soaks in the ground and a considerable amount is lost by evaporation. There is the danger of rain washing the oil away; the oil stored in the earthen pit is a fire risk; and certain damage to the land results from storing the oil in pits or dams. The building of the dam or the excavating of a pit sufficiently large to hold the oil is expensive. There is also the added time and expense of pumping the oil back into the line.

If a parallel line were available, the old practice was to install a saddle connection with a stop cock or gate and transfer the oil from one line to the other. A portable reciprocating pumping unit, known in the industry as a "pick-up" unit, was used to transfer the oil. Such a pumping unit has a capacity of 60 to 100 bbls. per hour. At this rate of pumping, too much time has been required to transfer the oil; during the period the oil was being transferred the pressure on the operating line must be reduced and, consequently, the line ca-

Fig. 15

pacity is lowered. This method has made it necessary to leave the saddle and connections on the line, which is undesirable on account of the risk of losing oil by leakage, from connections, or the blowing out of the gasket or the breaking of the valve or stop cock. There is an appreciable amount of corroded pipe and an accumulation of temporary repairs on the older lines on account of the drawback.

The Hill-Polston Tapping Device

31. To meet the objectionable feature of leaving a saddle connection on the line, a new type of tapping machine and connections were developed by Superintendents J. E. Polston and A. M. Hill of the Stanolind Pipe Line Co. for transferring oil from one line to another. This

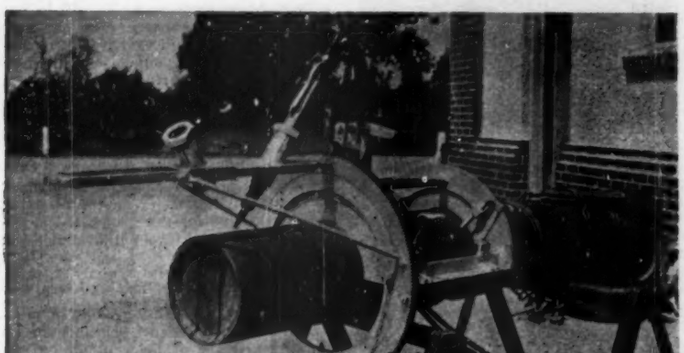


Fig. 16

equipment is shown in Figures Nos. 9, 10 and 11.

The first step in making the transfer of the oil is to electrically weld a specially designed forged steel nipple to the line which is to be drained, and also to the line into which the oil is to be transferred. This special nipple is forged with a heavy wall and one end is shaped to fit the curvature of the pipe. The other end has a special thread on the inside and a standard 3-inch thread on the outside.

After these special nipples have been welded to the line, a high pressure 3-inch gate valve is screwed on the nipple. This tapping device with a stuffing box is screwed to the other side of the valve. The valve is opened and a 2-inch hole is drilled through the pipe by a drill fitted to a drill-shaft which is operated by the ratchet type tapping device. The drill is drawn back of the valve disc and the valve is closed. The tapping device is disconnected from the valve to make the connections for transferring the oil. When the transfer of the oil has been completed, the tapping device is screwed into the valve again for the purpose of screwing a specially designed solid forged steel plug into the inside thread of the nipple, welded to the line. The head of the steel plug fits the shank used for the drill, and the same operation for tapping the line is used except that instead of drilling, the plug is screwed into the nipple. After the plug is tested for tightness, the tapping device is unscrewed and the valve is removed. A 3-inch coupling and bull plug is screwed to the outside thread of the nipple welded to the line. The inside plug prevents any leakage, but the outside bull plug is provided to preserve the working features of the inside plug for future use. The outside bull plug and coupling is coated with asphalt to protect it against corrosion. A record of all such connections is made on the line maps for reference when the drainage of the lines may be necessary again. Some of these connections have been made on lines at the foot of long drainage areas for no immediate use, but for future service. The operations which have been described above have proved eminently satisfactory and all of it can be done with the loss of a few gallons of oil which drain from the tapping connections.

Centrifugal Pick-Up Unit

32. As a result of our company's policy to make use of "patching" with the electric arc welding only when it was absolutely necessary, new methods had to be developed for replacing pipe and draining the lines.

Too much time was required to transfer the oil with the low capacity "pick-up" unit and a new type of pumping unit was developed to handle a large volume of oil at a low pressure, rather than a small capacity at a high pressure. This piece of equipment which does not represent, however, the description of the latest model as outlined above, is shown in Figure No. 12, assembled as a unit. It consists of:

(a) Seventy-five horsepower Type V-8 Ford motor, 3,000-r.p.m., self starting, mounted on skids and directly connected with a flexible coupling to

(b) A two-stage centrifugal pump with a capacity of 300 bbls. per hour at 250 pounds pressure.

(c) Assembled crude oil piping system, with a check valve on the discharge line.

(d) Turbine type oil meter connected in the discharge piping system.

(e) Two pieces of 4-inch flexible steel hose about 8 feet long for the suction connections and two pieces of 3-inch (250 pounds pressure) flexible steel hose for the discharge connection.

(f) Various lengths of 3 and 4-inch pipe, also nipples grooved for the "groove and gasket" type coupling.

(g) Supply of groove and gasket couplings.

(h) Pressure gauges for the suction and discharge.

(i) Strainer, assembled in the suction line.

This pumping unit weighs about 1,400 pounds, which facilitates the transportation and movement of it.

The flexible hose and the grooved couplings have been provided to save time in making the suction and discharge connections between the line and the pump. The strainer is attached to the unit and permanently assembled in the suction piping while the check valve is permanently fixed in the discharge piping. By the use of the flexible steel hose no fittings are required and the joints are made by means of the groove and gasket coupling. Thirty to forty minutes are required to connect the unit ready for transferring the oil. The unit has proved thoroughly practicable. The principal difficulties encountered were that the field men did not know how to use the centrifugal pump, but after instructing the men on this type of pump, no further difficulties were experienced, except that on one or two occasions the men failed to use a strainer and the pump became clogged with foreign substances. This equipment can be moved to the job much quicker and about one-fourth as much time is needed to connect the unit and transfer the oil as was required by the old method.

The Use of Concrete Plugs and Compressed Air

33. In the case of a multiple system of lines it is possible to transfer the oil from one line to another, but a different arrangement must be made for single lines. Since it was recognized that the draining of the oil into earthen pits was not only expensive but dangerous, our company has used, with success, two methods for displacing oil in a drainage area where pipe must be replaced.

For large drainage areas, our company had developed a method which makes use of a concrete plug, formed by forcing into the loaded oil line under pressure a quantity of quick setting concrete in the proportion of one part cement and three parts sand. The concrete is a moderately dry mixture. The plug may vary from 8 to 12 feet in level pipe, and considerably less, of course, in a sag. The pipe can be stripped, raised above the ditch and sagged between skids to obtain a short plug. The concrete sets-up within 12 hours and is ready for service at the end of 24 hours. The nipples, which have been described above, are welded to the line on either side of the concrete plug, the line is tapped, and the oils transferred from one side of the plug to the other by the centrifugal pick-up unit. After the line has been drained on one side, it is cut and the bad pipe is taken out, and a high pressure gate valve installed in the drained line with forged steel flanges. One of the nipples used for draining the line has been welded beyond the gate valve and connected for transferring the oil from the other side of the concrete plug into the line beyond the closed valve. With all of the oil transferred, the bad pipe is replaced with new pipe which is flanged in to the open end of the gate valve, which is left in the line. Another drainage plug nipple is welded on to the new pipe at a suitable distance from the valve to take care of future drainage in this area. The concrete plug holds against 200 pounds pressure before any leakage develops. This method is used only for long drainage areas of single lines, 6 inches or larger in diameter.

Fig. 17

For the smaller drainage areas, compressed air is being used successfully for displacing the oil. The length of this paper will not permit a discussion of the procedure.

Equipment and Tools

34. The extensive building of new gravel and concrete highways throughout the country during recent years has resulted in a trend to the use of faster and lighter weight trucks, which has not only expedited but also facilitated the maintenance work on pipe lines.

The heavy duty tractors, equipped with booms and winches, have revolutionized the methods of laying new lines. The use of the "cradle" swung from the tractor boom has been especially valuable in supporting the line for the cleaning and coating operations. The "cradle" rolls along and supports the line as the tractor keeps moving ahead.

When electric welding first came into use, some companies made the electrical generator a part of the truck equipment with the generator mounted, in many cases, under the seat of the truck and driven by the truck motor with a special power take-off. An electric welding truck of this type is shown in photograph No. 13. Although these welding trucks have proved very valuable, this power take-off has caused considerable trouble and it has been necessary to replace this power take-off almost once each year at a high cost. Another disadvantage of this combination is that an expensive truck is restricted in its usefulness. As a result of these experiences, our company has taken the generator out of the truck when the power take-off had to be replaced and reassembled the generator with a Ford V-8 motor on a separate trailer. The truck was rebuilt for a different class of service. The rebuilt truck and trailer are shown in photograph No. 14.

Air compressors have been usefully employed by our company for repairs of tanks, cleaning tanks and pipe by sand blasting. As pointed out in another part of this paper, compressed air is being used successfully in displacing oil in the small drainage areas of oil lines.

Many of the pipe line hand tools have become obsolete. The hand threading dies and laying tongs for sizes of pipe including 8 inches and above are obsolete. Carrying irons, jacks and jack-boards for the larger sizes of pipe are in the same class.

Many of these tools have accumulated in tool houses and warehouses because operating men have hesitated to junk this class of equipment. A few threading dies should be kept, but it is the author's belief that the remaining tools should be sent to the scrap pile to save warehouse space, as well as expense of inventories and handling. The old type of Barnes cutters are being replaced by the ratchet type cutters, especially in the larger sizes.

Equipment Buildings

35. As long as the pipe line industry was using only hand tools, a tool house or a warehouse provided sufficient room for the storage of materials and equipment, but during the years when the pipe line industry has been going from hand tools to machinery, much of the equipment, such as the "pick-up" pump, tractors, trailers, tar pots, compressors, etc., was stored along the property fence. Our company recognized the need of equipment buildings for the storage of materials and the care of equipment, and these buildings of the type shown in photograph No. 15 have been built at different divisional headquarters for pipe line crews. Such buildings have been of material value in carrying out a program for training the workmen and foremen to take good care of their materials and equipment. The building is of steel framework with corrugated galvanized iron sheets for the roof and walls. The foundations and floors are made of concrete. There are eight stalls for the storage of

equipment with a shop on one end and room for the storage of tools and materials on the other end. These buildings cost about $4,000 each. Our experience indicates that such buildings are necessary for carrying on effectively our maintenance programs.

Dismantling Old Lines

36. There is a marked trend on the part of oil pipe lines to salvage the pipe from idle lines and make use of it in the construction of new lines. When the old line is dismantled, the usual practice is to either cut out all couplings or every other coupling. If every coupling is cut out, the 20-foot (approximately) lengths of pipe may be welded into 40-foot lengths before it is moved to the new line or the joints may be strung on the new right of way and welded there. If a coupling is left in the 40-foot length of pipe, it is customary to electrically weld both sides of it. An automatic beveling and cutting machine, which is shown in photograph No. 16, is used for this work.

Our company is using the following procedure in dismantling some 6 and 8-inch lines:

(a) The cleaning machine is run over the pipe while it is over the ditch.

(b) The pipe is carefully inspected and classified as:

"A Grade"—Second hand pipe.

"B Grade"—Second hand pipe.

Junk.

The "A Grade" pipe has no pits in it with more than 75 mils depth.

The "B Grade" pipe has pits less than 130 mils deep.

Pipe with many pits over 130 mils deep is classified as Junk.

(c) An effort is made at the same time to determine the effectiveness of coatings on the line, to correlate the corrosion of the pipe with the soil, an electrical survey and miscellaneous corrosive conditions.

(d) After the pipe has been examined and classified all couplings are cut out with the pipe over the ditch, and a 37-degree bevel is cut in the same operation.

(e) The 20-foot lengths of pipe are then hauled off the right of way to welding tables located at points carefully selected along main traveled highways where the pipe is welded into 40-foot lengths.

(f) The pipe is checked again on the welding tables and as much of it as possible is salvaged. All spot welding and the welding together of short lengths is done on these welding tables before the pipe is moved to the new right of way.

(g) The "B Grade" pipe is cleaned thoroughly and laid in the line, with a composite coating of parolite and asbestos felt paper. On account of it being a lower grade of pipe, it is used along the high elevations of the line, so that in case a failure occurred little damage could result from a leak after the pressure is taken off the line. Another reason for using this class of pipe on the higher elevations is that better surface drainage should mean less corrosive conditions. This class of pipe is not laid in places where corrosive conditions are anticipated. This procedure puts back into useful service, with little or no risk, a class of pipe which would find little or no use and only become an expense in a pipe yard.

Coating Lines

37. Within the short period of six years many types of coatings have been tried—primer paints, oil and lead paints, emulsified asphalts, greases, unwrapped hot asphalts and coal tars, concrete, as well as composite coatings of asphalt with an asbestos felt paper as a wrapper, or wrapped coal tars for coatings. Few if any coatings, intended for a long life, are applied without a wrapper such as asbestos felt paper.

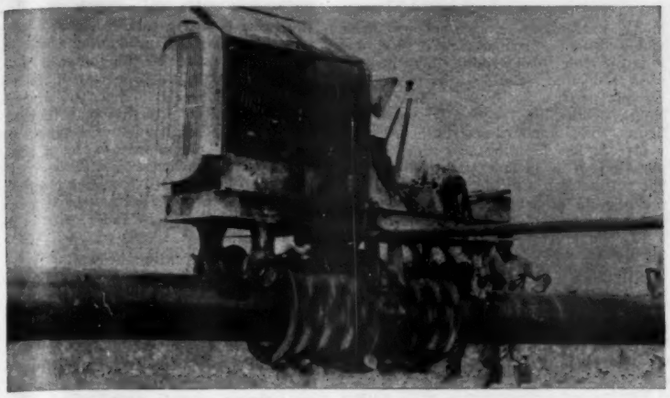


Fig. 18

Many companies have followed the policy of putting new lines in the ground bare, except in areas which are known to be corrosive. Our company is one of the few which continues to coat new lines over their entire lengths. We are looking at the corrosion problem 10 years from now rather than at its present aspect. Our experience with about 7,000 miles of oil lines, which, as an average, has been in the ground for a little more than 11 years, has enabled us to reach the conclusion that each year of temporizing will add a serious burden to the operation of the lines in the future.

In general, our composite coating of asphalt and asbestos felt paper has proved sufficiently satisfactory to warrant our policy of coating new lines over their entire lengths.

A few years ago it was very difficult to obtain a satisfactory coating in the field because of such factors as:

(a) Unsatisfactory cleaning methods.
(b) Slowness of work and delay to contractors.
(c) Poor application of coating.
(d) Moisture on the pipe.
(e) Poor workmanship.

All of these objections except the trouble encountered with moisture on the pipe have been met.

The use of heavy tractors and the cradle has facilitated and expedited the operations. Photograph No. 17 shows such equipment being used on about 80 miles of 10 and 12-inch line laid recently.

New Type Cleaning Machine

38. The perplexing problem of cleaning the pipe has been solved by the use of a traveling type cleaning machine, shown in Figure No. 18, equipped with a double set of rotating cutter wheels and brushes. It is equipped for two cleaning speeds and will clean 6,000 to 7,000 feet of new pipe in 8 to 10 hours. The cleaning machine travels along the line back of a heavy duty tractor which is equipped with a boom and "cradle" that permits the tractor and the cleaning machine to move forward without the delay of stopping to lower the line on the skids and move forward to pick it up in advance. This new type of cleaning machine is adapted to going over most bends, which eliminates the time in removing and putting the machine back on the line on account of bends. It is a valuable piece of equipment for the pipe line industry and the W.K.M. Co. deserves considerable credit in developing it, but it is regrettable that the manufacturer has not been able to offer it to the industry as well as the spare parts at a price which would permit a more extensive use of it.

It is noteworthy that the equipment referred to above was used for coating about 80 miles of 10 and 12-inch pipe

The cleaning and coating work was done, notwithstanding bad weather, at an average rate of about 6,000 feet per nine-hour work day.

Coating Machine

39. The application of hot coatings, such as asphalts and coal tars, has always been done by a rather crude hand method, which is familiar to most of us. The hand application ruins the workmen's clothes; it is slow; it results in burns and injuries to the workmen; a large loss of asphalt occurs; and results in gas bubbles and voids in the coatings. A coating machine, developed by J. B. W. Gardiner, is shown in Figure No. 19. This machine was given a practical test on a 10-inch line which was laid recently. All who observed its operation were of the opinion that this coating machine is a practical piece of equipment for applying hot coatings of asphalt and coal tar. The machine corrects most of the faults found in hand applications. There is an urgent need for a machine of this kind if it can be sold or leased for a reasonable amount of money.

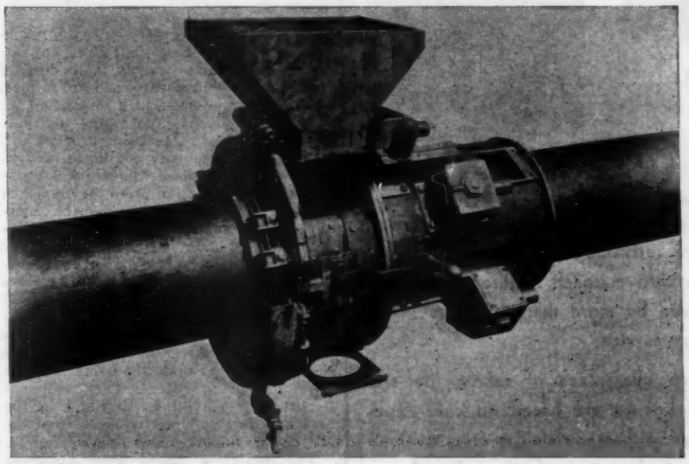


Fig. 19

Too often inventors narrow not only the use that could be made of new inventions but also their own profits by overestimating their worth. It is not uncommon for inventors to base the price or rental of a machine on the basis of how much can be saved over hand methods. Such a basis for determining the price will only cause an ill will among those who have need for such a piece of equipment.

Hand Operated Wrapping Machine

40. The hand operated spiral wrapping machine, shown in Figure No. 20, was developed by the Johns-Manville Co. This device has filled the urgent need for a means of making a tight bonded application of the felt paper to the hot coating of asphalt. As much as 8,000 feet of 10 or 12-inch pipe can be wrapped in a period of eight hours. It is a practical piece of equipment and has aided materially in the development of methods for applying coatings.

There remains the problem of drying the line either of frost or dew during the early morning hours or the water after a shower. Most coatings cannot be applied over a wet surface, and considerable delay occurs on account of the pipe having moisture on it. This objection will also be met before long by the development of a practical piece of equipment for removing the moisture and drying the pipe.

Outlook for Coatings

41. It is the writer's opinion that, although the industry has been justified in following, during recent years, a policy of coating lines only in the "corrosive" areas, commonly known as "hot spots," there are good reasons for believing that the pipe line companies will begin turning their attention again to the use of coatings for the protection of lines. The following reasons support this viewpoint:

(a) Satisfactory methods and equipment have been developed for the application of coatings under field conditions without delay to the construction of the line.

(b) There is no promise of obtaining a noncorrosive steel for oil pipe lines.

(c) There is no tangible proof of the cathodic protection of long pipe lines.

(d) A coating is the common means of protecting steel against corrosion.

(e) There is a definite trend to the use of lighter weight pipe and coatings will be required.

(f) The use of a coating will permit

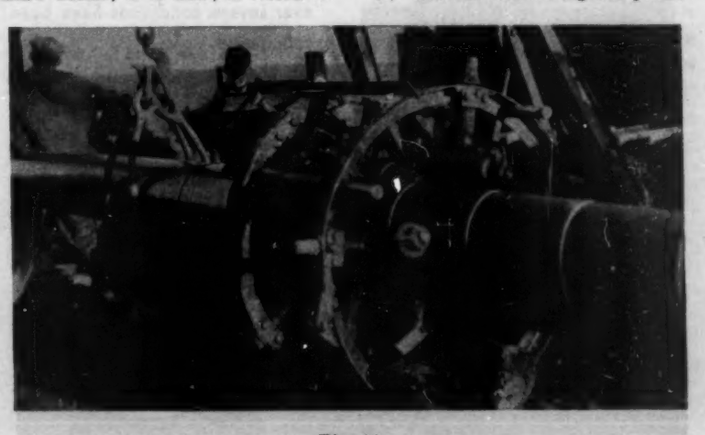


Fig. 20

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36

LEACH Fracto Control

the use of a class of salvaged pipe, such as the "B Grade" second hand pipe, described in this paper. Except for the coating, this class of pipe could not be used in the ground again.

(g) A large amount of pipe is being salvaged from idle lines to be used in newly laid lines. In salvaging this pipe it must be cleaned for inspection and classification. It is reasonable that such pipe should not bee relaid in the ground without a coating.

(h) Soil surveys, earth resistance tests, etc., cannot take into account the many extraneous causes of corrosion which develop after a line is laid and it is difficult to determine only the part of a line that should be coated. This reason justifies the coating of the full length of the line, especially when pipe lighter than standard weight is used.

(i) It has been learned that the application of a primer paint is helpful, but the asphalt coatings have preserved the pipe in a condition almost as good as new, except where corrosive conditions were encountered—this results in a high salvage value and a low expense in reconditioning when the pipe is moved to a new line.

A thread and coupling line is always subject to leakage and because the crude oil dissolves the various coatings it is not economical or desirable to coat a thread and coupling line.

The writer acknowledges, with appreciation, the help of W. D. Mackintosh of the Stanolind Pipe Line Co. in compiling some figures for this paper; also the assistance of J. C. Stirling, corrosion engineer of the Stanolind Pipe Line Co., for his suggestions, proofreading and supplying pictures.

Committee's Work Is Explained by Franklin

(Continued from Page 26)

untarily, by the great importing companies. Without that limitation, any attempt to balance supply and demand would have been foredoomed to failure. Today we know how much foreign oil we may reckon upon. We know, too, how much of our own American product will be necessary to supply our home market. While there are those who are seeking to break down the limitation of imported petroleum and petroleum products, sometimes using political pressure, sometimes resorting to other methods which need not be mentioned, the importers themselves will eventually see, if they have not already seen, that they, too, will profit from the limitation now imposed upon these foreign materials. Each price increase will register upon their balance sheets as well as upon the balance sheets of American producers. They will not import as much oil as they did in the past but they will receive more from the oil they do import under this restriction.

The limitation placed upon American production would increase the value of the foreign oil in the same degree that it increases the selling price of our home product. Conversely, this limitation on petroleum importations will strengthen the whole price structure throughout the country and by reason of giving a greater value to fuel oil will eventually affect the ultimate consumer in making possible such a distribution of the increased costs that the motorist will not be called upon to pay more than his due share of the advances made necessary by the NRA.

Through the limitation of the importation of foreign oil, now supplying so much of the fuel oil markets of the eastern seaboard, there will be a greater demand for domestically produced crude for fuel purposes. Much oil ordinarily cracked for gasoline will enter the fuel oil market. This will necessitate and furnish a market for a larger production of crude oil. The distribution of price advances over the whole range of petroleum products will put less of the burden of advancing prices on gasoline and thus relieve the motorist of any undue share in these advances.

Equally vital was the prohibition placed upon the withdrawals from storage. Some of this oil in storage had been purchased at sheriff-sale prices. It it had been dumped upon the market at the time when the limitation of production made possible the beginning of a price increase for crude oil, that price increase would have been halted immediately. This would have defeated the whole purpose of the petroleum code of fair competition to so restore the price for crude and products as to enable the industry to give employment to 250,000 additional men at fair wages. No ultimate loss will be suffered by those whose stored oil is at present shut away from the market. Whenever the price is safely established at a point above the average production costs, the augmented value of this oil will many times repay the postponement of its marketing. Whenever it is released, probably in quantities so adjusted that they will not upset the balance between supply and demand, its holders may expect a profit. That profit, however, cannot be reaped immediately since that would mean the total wreck of all that we have gained through our sacrifices and efforts in the past months.

A peculiar situation is created by additions made to storage, totaling over 5,0 0,000 bbls. over a period of practically a month ending October 7. This is a plain violation of the code. At the very time when many refiners were clamoring for a supply of crude oil to furnish their current consumptive requirements, and earnest appeals were made for permission to withdraw oil from storage to prevent refineries from closing down, a few companies were adding to storage the supplies vitally necessary to others and which, under the restricted plan of production, they had difficulty in securing. Each barrel thus subtracted from the legitimate refinery needs made more difficult the task of balancing supply and demand. Its continuance would defeat the purposes of the petroleum code. Eventually it would return the industry to that demoralization from which it has been slowly emerging. Without imputing any motives to those who have placed this oil in storage, one can, at least, point to the damaging effect this practice cannot fail to have upon any effort at stabilization.

Cost Recovery Basis

Conservation of our petroleum resources has claimed the attention, not only of those engaged in the industry, but of the public and the Government as well, for the last 10 years or more. But true conservation cannot be attained if the price of crude oil and the products thereof is so low that through competition with flush producing areas, it becomes economically impractical to operate the 300,000 stripper wells, thus forcing their premature abandonment and the loss of the billions of barrels of reserves they represent.

A cost recovery basis, such as is apparently contemplated by the NRA, must ultimately be determined if the oil industry is to be rehabilitated. This is not price fixing. No artificial attempt to insure profits is involved in this. It is merely a step in fullest accord with the letter as well as the spirit of the National Industrial Recovery Act to prevent sales below cost, in order to more certainly insure employment and to increase purchasing power. Above minimum prices based on cost, economic forces would have full sway.

The balancing of supply and demand, made possible partly by the allocation orders issued by the oil administrator after consultation with the Planning and Co-ordinating Committee and with the co-operation of state authorities and partly through the elimination of "hot oil" which had been defeating any attempt at stabilizing production, will not be sufficient unless a fair price can be obtained.

One important factor in arriving at our goal in the restoration of the industry cannot be ignored. Public opinion must be thoroughly informed concerning the situation in which this industry finds itself, the millions who are more or less directly dependent upon it, the key position which it holds in our industrial

structure, and the necessity for either a higher price paid by the consumer for petroleum products, or else the reduction of the growing burdens of taxation. Widespread propaganda has been issued directed against any fair price to be paid for either crude petroleum or its products. In the press and over the radio there has been going out this stream of propaganda, implanting in the popular mind the false impression that the petroleum industry is seeking to profiteer through the NRA at the expense of the American people. This naturally predisposes the autoist to believe that if prices advance it will be without justification and a profiteering move.

Educating the Motorist

The heavy taxation carried by petroleum products is not fully realized by the consuming public. It is for that very reason that legislative bodies have found it so easy to levy gasoline taxes, which at times have been over 200 per cent of the wholesale price.

It is not the province of the Planning and Co-ordinating Committee to conduct a campaign for the reduction of taxation on petroleum products. Such action does not come within the scope of our activity. But if the industry itself cannot find a way to inform the American people, when they buy gasoline at the service station, that they are not merely purchasing fuel for their motor car, but that they are also paying many millions of dollars in concealed taxation, then the industry cannot expect the American people to accept any increase in the price levels without imputing get-rich-quick motives to a great industry which is fighting for its life.

The increased labor cost of over $300,000,000 placed upon our industry by the compliance with the National Industrial Recovery Act and the code must be met somehow. It cannot be paid out of nonexistent profits. Neither can it be added to losses we have long sustained. There is only one source from which we can pay this added cost. The money must come from the purchaser of petroleum products. It is unfortunate that the oil industry may be the only industry in the country which will find it necessary to go before the American people in a campaign of education in order to make clear how small a proportion of the price paid for petroleum products goes to the industry and how much of it goes for excessive taxation. Public sentiment, however, cannot be ignored. Neither can it be fought successfully. It can be educated. The American public is fair when informed. Upon the success of an attempt to inform the American motorist—and that means practically the entire American public—just why the service station must charge more for every gallon of gasoline, depends the ultimate success of all the things we are striving for.

Not a Racket

"A good name is rather to be chosen than great riches." The petroleum industry is realizing that today. Some of us who have had bitter experience in seeking Federal legislation on subjects important to the industry have been made to realize this. The history of many years, during which laws were evaded or openly flouted, rises up against us each time we attempt to take a forward step. The American people do not differentiate between the small minority who were guilty either in the long past or in the current year, of practices that were unethical, to use a mild term, and those who were the victims of those practices. In the minds of the American people the oil industry is the oil industry, and little distinction is drawn between men and corporations of high integrity and those whose records may not bear the fullest investigation.

It is imperative today that we should make it absolutely clear to the man in the street and the man in the garage and the man everywhere that the oil industry is not a racket, but that it is a legitimate business, employing armies of men, furnishing the mainstay of nearly half the states of the union, providing the consumptive power which keeps alive probably half of the factories in the industrial sections of the country, paying in Federal, state and local revenues incredible fortunes every year. Because some men have erred, or because some corporations have been guilty of sharp practices in the days that are gone and ought to be forgotten, this great industry should not today be penalized nor should it even be forced to endure the breath of suspicion.

No Marked Cards in New Deal

There is a New Deal. There are no marked cards in the deck today. No sharp practices will be tolerated. Every oil man, regardless of whether he is operating as an individual or part of a corporation, whether his dealings are small or large, whether his interests lie in production, in refining, in marketing or in transportation, should resolve that in the fullest possible degree he and those over whom he has control should live up to the spirit and not merely the letter of the code. On that code depends everything for the petroleum industry, and may I remind you, upon the restoration of the petroleum industry, basic in our idustrial life, depends to a very great extent the restoration of American prosperity.

This spells the doom of a certain type of men to whom the oil industry owes no debt whatever. The smart lawyer, always finding loopholes through which his company might creep if it would make itself small enough or stoop low enough, will find his occupation gone. The hair-splitter, the man who with a microscope hunted for little technicalities in the law, which he might so magnify that they would hide a breach of its spirit, these men who in a distorted sense of loyalty to the corporations that hired them, often brought the whole industry near the verge of ruin, will have no place in the New Deal. Their mere existence has always been a source of weakness. The small man with little capital, with no strong political affiliations, often unable even to maintain membership in any trade organization, has felt that he was not compelled to obey laws, orders and regulations, when some great wealthy corporation could hire a lawyer who could find a detour by which that corporation might pass.

Today there is just one law for the great and the small. Not even the cleverest corporation lawyer in the industry can persuade those in charge of administration of the present code to take any steps granting special privileges or favors to his company. The honest lawyer will not try. The company which is loyal to the nation's effort at restoration will not permit any attorney in its name to make such an effort. If ever the "smart" man had any place in the oil industry, that day has passed. A new deal is here and the cards are face up on the table for all to see.

Not Automatic

But the New Deal is not automatic. You and I and the thousands of others in the petroleum industry will have to make it operate—if it is to operate successfully. We can make it a success or we can cause it to fail. If it succeeds, we succeed with it. If it fails, we too fail. Our task will not be easy. We will all have to face new conditions. We, like all the rest of our industrial world, will have to learn to operate under governmental guidance and aid.

We are now in a position to head the march back to prosperity for the whole nation. Let us do this proudly and joyously, glad that we have an opportunity to add our co-operative effort to the nation's onward movement. We are not being driven or forced into this New Deal. Neither is it someone else's program that we are being compelled to follow. It is our own fight out of the jungles where the stern law of the survival of the fittest has slain its thousands. It is our own effort to establish justice and fair dealing in our own industry. This is our own New Deal and our own code of fair competition. It can win; it should win; and it shall win.

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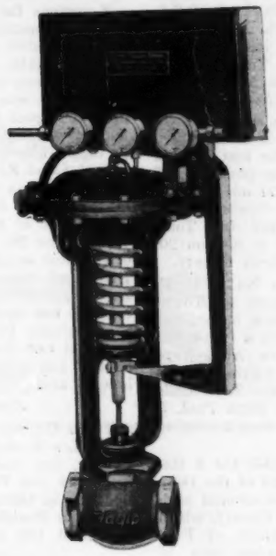
... Because the Taylor Dubl-Response Unit is *mounted on the valve.*



Taylor Dubl-Response Control Unit in position on a Taylor Evenaction Diaphragm Valve.

NOT ONLY does the Taylor Dubl-Response System provide a sliding adjustment for sensitivity or throttling range (an exclusive feature).

Not only does it offer an automatic "reset" for load changes.

But more important, it compels the valve to respond *precisely* to commands from the control instrument. It assures instant and automatic action.

There was a reason for mounting the Taylor Unit on the valve! It is the one way to get *precision valve action.*

That is why the Taylor Dubl-Response System will outperform all other regulators on difficult temperature, pressure or flow control installations.

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SPECIAL TAYLOR NEWS FLASH

Beginning October 1st all Taylor Temperature and Pressure Recorders and Recording Regulators will be shipped in a new die-cast case originated by a noted American product designer. This modern case, with many distinct Taylor improvements in the mechanism of the instrument inside, represents another step in the effort to provide industry with the most up-to-date temperature and control equipment. More later.

† Tycos Taylor TEMPERATURE and PRESSURE INSTRUMENTS

† The name Taylor now identifies our complete line of products including Tycos instruments.

INDICATING • RECORDING • CONTROLLING

Three New Locations in Ector County District; Four in Archer County, Nine in Panhandle

By L. E. BREDBERG
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Oct. 23.—Three locations were made in Ector County the past week by the Atlantic Oil Producing Co., two in the northern part of the county in Section 19, Block A, P.S.L. Survey on the Holt ranch. Location for No. 1 Jones was made in Section 36, Block 43, Township 2s, T.&P. Survey, east of Fred Turner's No. 1-A Addis, a producer in the Harrison-Addis district.

Landreth Production Co. and Llano Oil Co. completed No. 1 Holt in the northern part of the county for the best well in that district. After topping pay at 4,265 feet, it was shot with 260 quarts from 4,232-97 feet and started flowing at the rate of 435 bbls. of oil per day. Total depth is 4,313 feet. It is in Section 20, Block A, P.S.L. Survey, Ector County.

Broderick and Calvert's No. 1 E. F. Cowden in Section 25, Block 44, Township 2s, T.&P. Survey, which opened the fourth pool for Ector County a few weeks ago, is now running tubing. All storage has been filled and it is waiting on the completion of Humble Pipe Line Co.'s line being built from the Penn Pool, 5 miles south. The well has been averaging around 190 bbls. per day.

It is reported that Humble Oil & Refining Co. has purchased all of the Deep Rock block except 40 acres around each producing well in Andrews County, which is held by J. W. Tripplehorn of Fort Worth, and that three wells may be drilled in this area which has been dormant for almost two years. Humble Pipe Line Co. is extending its line from northern Ector County to the Andrews wells, the first outlet for this pool.

Ward County

Eppenauer Drilling Co.'s No. 1 University, in Section 2, Block 16, in the Grand Falls Area, Ward County, 2 miles from nearest production, appears to be making a good extension well. A second oil sand was logged at 2,725-30 feet, and the well flowed 70 bbls. the first hour. It is drilling deeper. Humble Oil & Refining Co. and Gulf will probably start drilling north and east.

Two dry holes were completed in Ward County. Gulf Production Co. abandoned No. 31 O'Brien at a total depth of 3,450 feet. A small showing of oil was had at 2,670-80 feet, and at 2,684-86 feet, but four bailers of water per hour were encountered at 2,730-35 feet, which increased to a hole full at 2,852 feet. A showing of gas was had at 3,100-11 feet. The other dry hole was completed by Sturm and others on their No. 1 Yell lease in Section 6, W. F. Stewart Survey. It was abandoned at a total depth of 2,604 feet after having a small show of oil and gas at 2,370 and 2,401 feet.

Crane County

Loffland Brothers' No. 1 Tubbs in Section 9, Block B-27, P.S.L. Survey, Crane County, is drilling at 4,268 feet in lime. Two bailers of water were encountered around 4,087 feet, approximately where Gulf Production Co.'s No. 1 Tubbs, discovery well one-quarter mile southwest, had a hole full of water.

Gulf Production Co.'s No. 103 McElroy, in Section 197, Block F, Upton County, is drilling at 7,406 feet in lime. This is an Ordovician test.

Four wells were completed in the Yates Field, Pecos County, the best being Sproles & O'Neal's No. 6-A Turner for an initial production of 1,667 bbls. per hour, total depth 1,661 feet.

Humble Oil & Refining Co.'s Ordovician test in Pecos County is below 5,301 feet. It is in Section 44, Block Z, T.C. Survey.

WICHITA FALLS AND RANGER

Locations for four new tests near the recently completed wildcat producer of C. W. Boller and associates on the Farmer-Perkins ranch in southwestern Archer County have been announced. The well which was discovered last week is estimated good for 100 bbls. daily, production coming from the lime pay. It is in the NW cor. Section 27, Bell County School Land Survey, A-12.

Location has been made by Boller and others for No. 3 Farmer-Perkins, one location east of the discovery in the SE cor. Section 26. The fourth well will be drilled due south of the producer. Tom Perry and others will drill in Section 17, northeast of the discovery well. A gathering line has been built into the area by the Magnolia Pipe Line Co. The discovery well had Gunsight lime at 1,415½-28 feet and was treated with 1,000 gallons of acid.

Cottle County

Texas Co. has made location near its No. 3 Les K. Johnson, in western Foard County, for another test. It is to be drilled on the Tom Burnett land across the line in Cottle County.

Sinclair Prairie Oil Marketing Co. has re-entered the purchasing field in the Central West Texas district and will offer the first outlet available for two years to many of the small "stripper" wells.

Fisher County

Roeser & Pendleton's No. 1 Hill, in Section 193, Block 1, B.B.&C. Survey, Fisher County, was completed for a nice well after treating with 1,000 gallons of acid. Lime pay was topped at 3,093 feet, and after treatment, was completed for an 800-bbl. well. Total depth is 3,093 feet. Before treating it was making 100 bbls.

PANHANDLE DISTRICT

Six completions and nine locations were made in the Panhandle district, all completions being in Gray County. Five locations were made in Gray County, two in Hutchinson County, and one in Wheeler County.

Daily average production for the Panhandle district was 45,106 bbls., an increase of 1,957 bbls.

The new allowable set by the Railroad Commission for the Panhandle district is 44,500 bbls.

COMPLETIONS IN WEST TEXAS

Ector County

Landreth Production Co. and Llano Oil Co.'s No. 1 Holt, show of oil from 4,110-15 feet, shot with 260 quarts from 4,232-97 feet, initial production first 24 hours, 435 bbls. of oil flowing by heads, total depth 4,313 feet.

Pecos County

Easter-McCurdy's No. 1-B Smith, top pany 1,003-05 feet, initial production 22 bbls. of oil per day pumping, total depth 1,107 feet. Mid-Kansas Oil & Gas Co.'s No. 34-A Yates, top pay 1,105 feet, initial production 35 bbls. per hour, total depth 1,259 feet. Sproles & O'Neal's No. 6-A Turner, top pay 1,515 feet, initial production 1,667 bbls. per hour, total depth 1,661 feet; No. 1-D Turner, top pay 1,102-12 feet, initial production 21 bbls. per hour, total depth 1,266 feet.

Ward County

Gulf Production Co.'s No. 31 O'Brien, dry and abandoned, total depth 3,450 feet. Sturm and others' No. 1 Yell, dry and abandoned, total depth 2,604 feet.

Winkler County

Sinclair Prairie Oil Co.'s No. 2 Scarborough, top pay 2,874-2,900 feet, initial production 45 bbls. per day flowing through casing, total depth 2,915 feet.

Wildcat Operations in West Texas

Week Ending October 23

BREWSTER COUNTY

Company, well, farm name, section and block—	Remarks:
C. M. Joiner's No. 1 McIntyre	Drlg. 1,010 ft.

COKE COUNTY

C. D. Hagerty et al's No. 1 Gaston, in Joseph Young Sur. No. 11	T.D. 710 ft.

CONCHO COUNTY

Mintex Oil Co.'s No. 2 Waring Estate, 660 ft. from N line, 150 feet from W line SW ¼ Sec. 2120, A. T. Robinson Sur.	Underreaming at 1,460 ft.

CRANE COUNTY

Gulf Prod. Co.'s No. 1 Edwards, 330 ft. from S line and 330 ft. from E line of Sec. 21, Blk. B-18, Pu lic School Land Sur.	Bldg. derrick.
Loffland Bros.' No. 1 Tubbs, 1,334 ft. from N line, 1,320 ft. from W line, Sec. 9, Blk. 27-B, P.S.L. Sur.	Drlg. 4,127 ft.

ECTOR COUNTY

Atlantic Oil & Prod. Co.'s No. 1 Holt, 1,980 ft. from N line and 660 ft. from E line of Sec. 19, Blk. A, P.S.L. Sur.	Location.
Atlantic Oil & Prod. Co.'s No. 2 Holt, 660 ft. from N line and 1,980 ft. from E line of Sec. 19, Blk. A, P.S.L. Sur.	Location.
Atlantic Oil & Prod. Co.'s No. 1 Jones, 2,310 ft. from N line and 440 ft. from W line of Sec. 36, Blk. 43, Twp. 2s, T.&P. Sur.	Location.
Broderick & Calvert et al's No. 1 E. F. Cowden, 2,340 ft. from E line, 330 ft. from S line of Sec. 25, Blk. 44, Twp. 2s, T.&P. Sur.	T.D. 4,338 ft.; swabbed and flowed 188 bbls. while cleaning out.
Skelly Oil Co.'s No. 1 Addis, 990 ft. from N line and 2,280 ft. from E line of Sec. 35, Blk. 43, Twp. 2s, T.&P.R.R. Sur.	Spudding.
Fred Turner's No. 1-B F. V. Addis, 440 ft. from the E line and 330 ft. from S line of Sec. 35, T.&P.R.R. Sur., Blk. 43, Twp. 2s	Drlg. 610 ft.

FISHER COUNTY

Conder Pet. Co.'s No. 1 Holley, 1,170 ft. W and 660 ft. from N lines of E half, Sec. 6, Blk. R, W. E. Richardson Sur.	Moving in material and R.D.
Cranfill & Reynold's No. 3 W. M. Flannigan, 165 ft. S of N line and 330 ft. W of E line of W half Sec. 300, Blk. 1, B.B.B.&C.Ry. Sur.	Drlg. 1,800 ft.
Cranfill & Reynold' No. 8 T. Willingham, Sec. 199, Blk. 1, B.B.B.&C.Ry. Sur.	Drlg. 2,605 ft.
Merry Bros. and Perl'al's No. 1 J. J. Steele, 330 ft. E and 150 ft. N of SW cor. NE Sec. 210, B.B.B.&C. R.R. Sur.	Moving in material.
Mid-Continent Petroleum Corp.'s No. 1 A. E. Pardue, 660 ft. N of S line and 330 ft. W of E line of NW Sec. 202, Blk. 1, B.B.B.&C.Ry. Sur.	Will treat with acid; T.D. 2,107
Roeser & Pendleton's No. 1 T. E. Hill, 660 ft. N of S line, 330 ft. E of W line of N half NW Sec. 193, Blk. 1, B.B.B.&C.Ry. Sur.	Swabbing 55 bbls. per hour after acid treatment; T.D. 3,093 ft.
Southern's No. 1 King, 660 ft. from N and 330 ft. from W line of SW Sec. 193, B.B.B.&C. Sur.	Spudding.
Southern Oil Co.'s No. 1-A Pardue, 2,310 ft. from S and 990 ft. from E lines of Sec. 202, B.B.B.&C. Sur.	T.D. 2,654 ft.
Texas Co.'s No. 3 T. A. Jean, 165 ft. N of S line and 330 ft. E of W line of E half Sec. 351, Blk. 1, B.B.B.&C.Ry. Sur.	Drlg. 2,020 ft.

(Continued on Page 101)

ROCKY MOUNTAIN RUNS

Average daily crude oil production for the week ending October 21 follows:

WYOMING

	Bbls.
Salt Creek	18,646
Big Muddy	1,776
Badger Basin	40
Byron-Garland	1,046
Byron-East	100
Dallas Derby	310
Dutton Creek	60
Elk Basin	566
Ferris	40
Frannie	210
Grass Creek	shut in
Greybull	10
Hamilton Dome	870
Hudson	196
LaBarge	1,086
Lance Creek	146
Lost Soldier	1,710
Mule Creek	shut in
Midway	76
Notches	shut in
Oregon Basin	600
Osage	630
Pilot Butte	30
Rex Lake	50
Rock River	1,296
South Casper	750
Poison Spider	240
Teapot	30
Warm Springs	shut in
Total Wyoming	30,450

MONTANA

Buckley-Border	260
Cat Creek	710
Cut Bank	900
Dry Creek	280
Kevin-Sunburst	3,400
Lake Basin	50
Pondera	770
Total Montana	6,430

COLORADO

Florence	310
Fort Collins and Wellington	550
Iles Dome	550
Moffat	540
Orchard	145
Rangely	90
Tow Creek	210
Total Colorado	2,410

NEW MEXICO

Artesia	590
Cooper area	70
Empire area	6
Eunice area	1,020
Getty Pool	0
Hobbs	33,530
Hogback	220
Hospah	shut in
Jal	1,670
Lea area	2,220
Jackson	940
Maljamar	290
Rattlesnake	870
Table Mesa	60
Total New Mexico	41,410
Total Rocky Mountain area	80,700
Total previous week	80,480
Difference	220

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PULL RODS	ROTARY COUPLINGS
PULL ROD CLAMPS	GOOSE NECK CONNECTIONS
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"OILWELL"

Long Lake Discovery Making 15 Barrels of Fluid an Hour, One-Third of It Being Salt Water

By L. E. BREDBERG

DALLAS, Tex., Oct. 23.—The Long Lake Plantation discovery well of Tide Water Oil Co. and Texas Seaboard Oil Co., which came in last week opening another pool for East Texas, in the southern part of the Woodbine sand sector, Anderson County, is still making a considerable quantity of salt water and b.s. Some think it is bottom hole water, the gas helping to force it up through or around the cement plug set at the bottom of the hole, 5,468 feet back up to 5,275 feet. More cement may be run in to test this belief, or a packer may be run at bottom of pipe in an effort to shut off the water.

Late reports state it is making 15 bbls. of fluid per hour through seven-eighths inch tubing choke. A third of this fluid is salt water, the owners using the two 1,000-bbl. tanks on the lease for settling tanks and erecting a 5,000-bbl. tank for lease storage.

Approximately 2¼ miles of 4-inch line is being tied in to connect the well to the Gulf Pipe Line Co.'s trunk line near Tucker Switch, which runs to the Gulf Coast.

New Test

Humble Oil & Refining Co. is spudding No. 1 Deitz test in the Simon Sanches Survey No. 6, approximately 3 miles west and north of the discovery well. This test will no doubt be rapidly drilled to find whether the field is to run north and west. If the Standard of Kansas' test was also drilled immediately the two tests would give a clearly defined picture on extensions in the two mentioned directions.

The Long Lake Plantation well has not only resulted in a big lease and royalty play in Anderson and adjoining counties but has brought many instrument crews to work the district. Shooting crews are working in Anderson, Houston, Freestone, Leon and Cherokee Counties, and no doubt several blocks will be taken by major companies as a result.

In the bend of the Trinity River which extends into Anderson County, and a little over a mile east of the Long Lake discovery, Standard Oil Co. of Kansas has staked a second location south of the above mentioned test on which drilling has been held up. The new location holds the key to possibilities for acreage east of the discovery.

The Railroad Commission has postponed its hearing on this area until October 30.

Two other locations have been reported near the Long Lake discovery but definite announcement has been withheld. Humble Oil & Refining Co. and Gulf Production Co. have been named as planning these tests, one to be across the river in Leon County, and the other near Elkhart in Anderson County.

Leon County

The Leon County wildcat of Shell Petroleum Corp. and others on the Beggs farm in the Carter Survey, on a 19,000-acre unitized block near the town of Centerville, has been bailing and carefully testing a sand lense which held an odor and showing of oil. Plug was drilled and tubing swung at 5,661 feet. Seven-inch pipe was cemented at 5,688 feet. The test was swabbed down 2,600 feet showing no oil. The tubing will probably be bailed dry, pulled and coring resumed if nothing further shows at this depth around 5,720 feet. The company is progressing slowly in order not to pass up any sand streak or drill into water. A former test on the block encountered encouraging looking sand cores but failed to pay off when tested. The test is approximately 25 miles southwest of the Anderson County discovery and other tests are expected to be drilled between the two areas.

There were two wildcat tests completed this week in East Texas. Three wildcat locations were staked, one in Leon County, one in Hunt and one in Cherokee County. Seventy-five wells were completed this week while locations were staked for 76 tests.

Sale of Properties

David Donoghue, as receiver for the E. L. Chapman properties, has sold properties to various parties, the majority on the west edge and in the water zone in Rusk County. The Johnson "A" and "B" leases in the Hollingsworth Survey, containing three wells were sold to Pete Coffman, J. H. Edwards and others. They also purchased the Williamson 150-acre tract in the Cook Survey, with one well; the Futch-Cooper lease of 50 acres with three wells in the English Survey; the Russell 37-acre tract with two wells in the same survey, and the Moore 10-acre tract in the Pru Survey. R. H. Deering & Sons purchased the 40-acre Finney tract in the Parker Survey, with three wells. J. Zeppa purchased the Minchew 20-acre tract with two wells in the Dance Survey. S. & W. Oil Co. purchased the 9-acre Goforth tract in the Lindley Survey, with two wells. In all 18 wells changed hands.

Tide Water Oil Co. purchased Peoples Petroleum Co.'s Fisher lease containing two wells in Gregg County, and Humble Oil & Refining Co. purchased Houston Oil Co.'s Clemmons lease with four wells, same county. Tide Water also purchased American Liberty Oil Co.'s M. A. Thrash lease with two wells, in Rusk County.

Daily Distribution

Daily averade distribution for the field for the week ending October 19 was 553,750 bbls., 512,390 bbls. being transported by pipe lines, 39,900 bbls. went to local refineries and only 1,460 bbls. per day went out by tank cars. There are now 25 refineries shut down in the field, or one-half of the number. Daily average production was 482,020 bbls. which is 71,730 bbls. per day under distribution. Transportation of oil from the field has been gaining during the past few months, production gaining but a slight percentage from week to week while distribution has gained materially. Tank car shipments are maintaining an average every week due to the close scrutiny of shipments by investigators from the Department of the Interior. Runs to refineries have been gradually decreasing as more and more of the small plants shut down.

East Central Texas Wildcats

Week Ending October 23

Company, well, farm name, section and block—	Remarks:
ANDERSON COUNTY	
Standard of Kansas' No. 1 A. W. Johnson, 565 ft. from N line and 420 ft. from E and W lines of 22.8-ac. tract, Simon Sanches Sur.	Derrick.
Tide Water Oil Co. and Seaboard Oil Co.'s No. 1 Long Lake Plantation, 3,700 ft. due S of S cor. of Tom Reeves estate, 97-ac. tract, Simon Sanches Sur.	Plugged back to 5,298 ft.; set csg. at 5,946 ft.; flowing 10 bbls. per hr.; 30 per cent B.s. and water through ⅝ and ¾-in. tubing; casing closed.
ANGELINA COUNTY	
J. M. Seward et al's No. 1 L. J. Dearman, 500 ft. from S and W lines of Dearman S 20-ac. tract, 2½ miles SE of Zavalla, J. T. Peavy Sur.	Spudding.
BOWIE COUNTY	
R. W. Lynn and W. R. Rolfe's No. 1 Mrs. R. D. Hart, 330 ft. out of NE cor. of Hart 20-ac. tract, 1 mile E of Nash, Thomas Price Sur.	Location.
CHEROKEE COUNTY	
A. F. Richardson's No. 1 P. Wood, 660 ft. from N line and 3,300 ft. from E line of 498-ac. tract, 14 miles E of Jacksonville, on Cherokee-Rusk County line, Ignacis Sanches Sur.	Location.
ELLIS COUNTY	
Beckham et al's No. 1 L. S. R. Wood, 150 ft. from N line and 330 ft. from E line of Wood 186-ac. tract, A. D. Lagarza Sur.	Derrick.
FRANKLIN COUNTY	
Van Emon et al's No. 1 O. S. Maxton, 910 varas W and 910 varas S of NE cor. of survey, John Brown Sur.	Derrick.
FREESTONE COUNTY	
Hughes et al's No. 1 H. A. Shaw, 330 ft. out of NE cor. of H. A. Shaw 138-ac. tract, Simon Sanches Sur. No. 5	Location.
Humble Oil & Refining Co.'s No. 1 Dietz Brothers, 1,000 ft. out of southerly SE cor. of 1,000-ac. tract, Simon Sanches Sur. No. 6	Derrick.
GREGG COUNTY	
Clover Leaf Petroleum Co.'s No. 1 M. T. Cole, 209 ft. from N line and center of E and W lines of survey, A. Parks Sur.	Waiting on cmt. to set 3,525 ft.
Elliott et al's No. 1 Benson, 175 ft. from S line and center E and W lines of tract, W. P. Chisum Sur.	Location.
Glasier et al's No. 1 Bumpass, 710 ft. from S line and 7,690 ft. from W line of survey, W. H. Castleberry Sur.	Rig up.
Claude Lee's No. 1 Black, 1,680 ft. from S line and 1,080 ft. from E line of survey, H. R. Hokit Sur.	Spudding.
Magnolia Petroleum Co.'s No. 6 Clem Jones, 4,710 ft. from S line and 870 ft. from W line of survey, G. W. Hooper Sur.	Drlg. 1,015 ft.
Shoultz' (receiver) No. 1 Williams, 900 ft. W and 90 ft. N of NE cor. of D. Dainwood Sur.	Derrick.
Sun Oil Co.'s No. 10 William Pentecost, 1,600 ft. from S line and 1,270 ft. from E line of survey, Mary Scott Sur.	Location.
S. K. Vierson's No. 4-A Andy Givens, 630 ft. from S line and 134 ft. from E line of survey, R. W. Smith Sur.	Rig up.
Yount Lee Oil Co.'s No. 1 V. A. Skipper and Garner, 330 ft. from N line and 1,870 ft. from W line of survey; J. Skillern Sur.	Rig up.
HENDERSON COUNTY	
Campbell and Champlin's No. 1 R. S. Ansley, 105 varas S and 623 varas W of NE cor. of lease, 6 miles SE of Buffalo, N. H. Thompson Sur.	Derrick.

(Continued on Page 101)

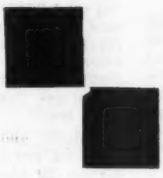
North Gregg County

Atlantic Oil Producing Co.'s No. 58 Judge, top sand 3,535 feet, initial production 75 bbls. per hour through open tubing, total depth 3,542 feet; No. 11 T. W. Lee, top sand 3,604 feet, initial production 75 bbls. per hour through open tubing, total depth 3,650 feet; No. 49 Moore, top sand 3,511 feet, initial production 85 bbls. per hour through open tubing, total depth 3,542 feet; No. 50 Moore, top sand 3,538 feet, initial production 80 bbls. per hour through open tubing, total depth 3,557 feet; No. 12 Prichard, top sand 3,504 feet, initial production 84 bbls. per hour through open tubing, total depth 3,535 feet. Bishop Oil Corp.'s No. 5 B. C. Todd, top sand 3,548 feet, initial production 90 bbls. per hour through open tubing, total depth 3,588 feet. Darby Petroleum Co.'s No. 7 Ritchie, top sand 3,525 feet, initial production 75 bbls. per hour through open tubing, total depth 3,577 feet. East Texas Oil & Refining Co.'s No. 5 D. Caldwell, top sand 3,505 feet, initial production 15 bbls. in 20 minutes through open tubing, total depth 3,520 feet.

Fain & McGaha Oil Corp.'s No. 2 Ritchie, top sand 3,583 feet, initial production 90 bbls. per hour through open tubing, total depth 3,625 feet. Gulf Producing Co.'s No. 45 Judge, top sand 3,520 feet, initial production 77 bbls. per hour through open tubing, total depth 3,545 feet. Howard Petroleum Co.'s No. 5 Stucky-Thrashear, top sand 3,560 feet, initial production 100 bbls. per hour through open tubing, total depth 3,601 feet. Humble Oil & Refining Co.'s No. 11 A. Carter, top sand 3,600 feet, initial production 59 bbls. per hour through three-quarters inch tubing choke, total depth 3,648 feet. Lesh and McCall's No. 6 Missie Young, top sand 3,504 feet, initial production 88 bbls. per hour through open tubing, total depth 3,568 feet. Lesh and McCall's No. 8 Missie Young, top sand 3,515 feet, initial production 80 bbls. per hour through open tubing, total depth 3,582 feet.

Magnolia Petroleum Co.'s No. 9 J. Allen, top sand 3,667 feet, initial production 84 bbls. per hour through open tubing, total depth 3,707 feet. Margay Oil Co.'s No. 6 R. Corbin, top sand 3,550 feet, initial production 75 bbls. per hour through open tubing, total depth 3,565 feet. Navarro Oil Co.'s No. 6 E. L. Walker, top sand 3,591 feet, initial production 80 bbls. per hour through three-quarters inch tubing choke, total depth 3,608 feet. Selby Oil & Gas Co.'s No. 5 Snavely heirs, top sand 3,570 feet, initial production 63 bbls. per hour through open tubing, total depth 3,585 feet. R. E. Smith's (Trustee) No. 2 C. Everett, top sand 3,498 feet, initial production 70 bbls. per hour through open tubing, total depth 3,519 feet. Snowden and McSweeney's No. 6 M. Bonner, top sand 3,573 feet, initial production 60 bbls. per hour through open tubing, total depth 3,590 feet. Sun Oil Co.'s No. 13 O'Brien, top sand 3,522 feet, initial production 75 bbls. per hour through open tubing, total depth 3,580 feet; No. 6-A Tooke, top sand 3,562 feet, initial production 85

On the pump *Electrically*



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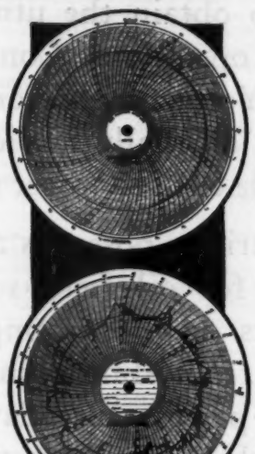

The two charts above illustrate the widely fluctuating volume (lower chart) and the extremely close regulation (upper chart) being maintained by the FISHER Wizard Back Pressure Regulator. This installation is shown at left.

Statement by Mr. Seppi Superintendent of Wilshire Oil Co.

Mr. Seppi, Plant Supt., states that the Stabilizer requires very little attention because of the reliability of their new Fisher Wizard Controls.

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Consulting Engineers

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bbls. per hour through open tubing, total depth 3,630 feet. Swallow's (Receiver) No. 4 Doby, top sand 3,472 feet, initial production 38 bbls. in one-quarter hour through open tubing, total depth 3,498 feet. A. W. Tarrant's No. 2 Sabine River, top sand 3,565 feet, initial production 65 bbls. per hour through open tubing, total depth 3,569 feet.

Tide Water Oil Co.'s No. 10 B. Moore, top sand 3,535 feet, initial production 15 bbls. in 10 minutes through open tubing, total depth 3,565 feet. Tillery Brothers' No. 3 Anderson, top sand 3,616 feet, initial production 90 bbls. per hour through open tubing, total depth 3,640 feet. Yount Lee Oil Co.'s No. 8 Hopkins, top sand sand 3,529 feet, initial production 63 bbls. per hour through eleven-sixteenths inch tubing choke, total depth 3,542 feet; No. 4 Mary McKinley, top sand 3,529 feet, initial production 65 bbls. per hour through eleven-sixteenths inch tubing choke, total depth 3,550 feet.

South Gregg County

Bostex Oil Co.'s No. 3 A. Spear, top sand 3,562 feet, initial production 60 bbls. per hour through open tubing, total depth 3,573 feet. F. E. Flannery's No. 3 M. T. Cole, top sand 3,557 feet, initial production 70 bbls. per hour through open tubing, total depth 3,562 feet. Henry Oil Co.'s No. 4 S. S. Ben Laird, top sand 3,538 feet, initial production 30 bbls. in one-half hour through open tubing, total depth 3,600 feet. Island Oil Co.'s No. 6 Register, top sand 3,583 feet, initial production 80 bbls. per hour through tubing, total depth 3,635 feet. Rhoads Drilling Co.'s No. 14 Sabine River, top sand 3,515 feet, initial production 50 bbls. in one-half hour through open tubing, total depth 3,545 feet; No. 15 Sabine River, top sand 3,535 feet, initial production 50 bbls. in one-half hour through open tubing, total depth 3,552 feet. Sun Oil Co.'s No. 8 William Pentecost, top sand 3,577 feet, initial production 53 bbls. per hour through open tubing, total depth 3,614 feet.

North Rusk County

Bowles Oil Co.'s No. 4 D. Wills, top sand 3,652 feet, initial production 50 bbls. per hour through open tubing, total depth 3,674 feet. Great Western Oil Co.'s No. 3 Birdsong, top sand 3,618 feet, initial production 75 bbls. per hour through open tubing, total depth 3,676 feet. Humble Oil & Refining Co.'s No. 77 L. D. Crim, top sand 3,622 feet, initial production 133 bbls. per hour through open tubing, total depth 3,669 feet; No. 23-A S. S. Laird, top sand 3,615 feet, initial production 75 bbls. per hour through open tubing, total depth 3,643 feet; No. 7-B W. P. Moore, top sand 3,662 feet, initial production 75 bbls. per hour through open tubing, total depth 3,686 feet; No. 13-B H. Sexton, top sand 3,648 feet, initial production 75 bbls. per hour through open tubing, total depth 3,732 feet. Tide Water Oil Co.'s No. 3-A Buntyn, top sand 3,702 feet, initial production 27 bbls. in one-quarter hour through open tubing, total depth 3,722 feet. Turman Oil Co.'s No. 6-A W. J. Brightwell, top sand 3,624 feet, initial production 35 bbls. in one-quarter hour through open tubing, total depth 3,634 feet.

South Rusk County

Ajo Oil Corp.'s No. 3-B Joe Lee, location abandoned. American Liberty Oil Co.'s No. 8 C. Young, top sand 3,689 feet, initial production 75 bbls. per hour through open tubing, total depth 3,740 feet. East Texas Oil & Refining Co.'s No. 2-C Ras Pool, top sand 3,689 feet, initial production 75 bbls. per hour through open tubing, total depth 3,740 feet. Humble Oil & Refining Co.'s No. 5 C. A. Brightwell, top sand 3,670 feet, initial production 56 bbls. per hour through open tubing, total depth 3,740 feet; No. 28-A M. and R. Kangerga, top sand 3,638 feet, initial production 112 bbls. per hour through open tubing, total depth 3,692 feet; No. 24-A S. A. Plowman, top sand 3,696 feet, initial production 75 bbls. per hour through open tubing, total depth 3,742 feet; No. 19 J. W. Turner, top sand 3,685 feet, initial production 85 bbls. per hour through open tubing, total depth 3,791 feet; No. 14 J. E. Wheelis, top sand 3,698 feet, initial production 55 bbls. per hour through open tubing, total depth 3,710 feet. Hunt Production Co.'s No. 4-F Bradford, top sand 3,590 feet, initial production 20 bbls. per day pumping, total depth 3,645 feet; No. 4 Finney, top sand 3,629 feet, initial production 20 bbls. per day pumping, total depth 3,728 feet; No. 2 B. F. Maxwell, top sand 3,668 feet, initial production 40 bbls. per hour through open tubing, total depth 3,750 feet.

Magnolia Petroleum Co.'s No. 5 Flannigan, top sand 3,646 feet, initial production 60 bbls. per hour through open tubing, total depth 3,677 feet. Mid-Kansas Oil & Gas Co.'s No. 59 M. M. Cross, top sand 3,610 feet, initial production 98 bbls. per hour through open tubing, total depth 3,626 feet; No. 48 W. T. Grissom, top sand 3,643 feet, initial production 98 bbls. per hour through open tubing, total depth 3,655 feet; No. 51 W. T. Grissom, top sand 3,634 feet, initial production 96 bbls. per hour through open tubing, total depth 3,654 feet; No. 14 M. A. Price, top sand 3,585 feet, initial production 44 bbls. per hour through open tubing, total depth 3,646 feet. Walker Murray and others' No. 1 W. H. Arnold, top sand 3,650 feet, initial production 20,000,000 feet of gas, light spray of oil, total depth 3,722 feet.

Rodgers and others' No. 1-B Daisy Bradford, top sand 3,600 feet, initial production 20 bbls. per hour through open tubing, total depth 3,620 feet. Rodgers Brothers' No. 3 W. A. Maxwell, top sand 3,687 feet, initial production 55 bbls. per hour through open tubing, total depth 3,730 feet. Standard Oil Co. of Kansas' No. 6 J. E. Wheelis, top sand 3,789 feet, initial production 75 bbls. per hour through open tubing, total depth 3,793 feet. Venable & McClanahan's No. 7 J. A. Birdwell, top sand 3,599 feet, initial production 90 bbls. per hour through open tubing, total depth 3,640 feet. Ward Oil Co.'s No. 9 Finney, top sand 3,682 feet, initial production 65 bbls. per hour through open tubing, total depth 3,727 feet. Joe Zeppa's No. 3 J. Menchew, top sand 3,757 feet, initial production 80 bbls. per hour through open tubing, total depth 3,762 feet.

Smith County

Gant & Wegener's No. 2 T. Stone, top sand 3,798 feet, initial production 80 bbls. per hour through open tubing, total depth 3,802 feet. McCullouch and others' No. 3 Church Lot, top sand 3,756 feet, initial production 75 bbls. per hour through open tubing, total depth 3,768 feet. Mid-Kansas Oil & Gas Co.'s No. 23 J. H. Sharp, top sand 3,648 feet, initial production 84 bbls. per hour through open tubing, total depth 3,650 feet. Texas Co.'s No. 11-A A. S. Jarvis, top sand 3,630 feet, initial production 95 bbls. per hour through open tubing, total depth 3,645 feet.

Upshur County

Atlantic Oil Producing Co.'s No. 10 Porter, top sand 3,686 feet, initial production 88 bbls. per hour through open tubing, total depth 3,702 feet. Cranfill & Reynolds' No. 8 L. Crews, top sand 3,649 feet, initial production 21 bbls. in one-half hour through open tubing, total depth 3,656 feet. Feazel & Davenport's No. 4 Phillips, top sand 3,654 feet, initial production 67 bbls. per hour through open tubing, total depth 3,684 feet. Humble Oil & Refining Co.'s No. 7 W. W. Holland, top sand 3,651 feet, initial production 51 bbls. per hour through three-quarters inch tubing choke, total depth 3,665 feet. Magnolia Petroleum Co.'s No. 2 C. Brooks, top sand 3,613 feet, initial production 60 bbls. per hour through open tubing, total depth 3,618 feet. Margay Oil Co.'s No. 6 Victory, top sand 3,600 feet, initial production 60 bbls. in one-half hour through open tubing, total depth 3,615 feet. Skelly Oil Co.'s No. 4 J. A. Free, top sand 3,656 feet, initial production 19 bbls. in one-quarter hour through open tubing, total depth 3,672 feet.

WILDCAT COMPLETIONS

Limestone County

Miller Drilling Co. and Joiner's No. 1 J. A. Stephenson, top Austin chalk 3,

650 feet, base 3,420 feet, top sand 3,828 feet, dry and abandoned, total depth 3,970 feet.

Rusk County

J. Heagens' No. 1 Needham, dry and abandoned, total depth 1,658 feet. John Keegan's No. 1 J. C. Strong, location abandoned.

Ickes Tells Institute Purpose of Government

(Continued from Page 24)

if it is believed that on that date an emergency exists that calls for the fixing of prices.

Not Assuming Facts

If the case for price fixing be conceded I submit that the way the administration has gone about it is both proper and orderly. We are not assuming our ultimate facts. We have not closed the case in advance of a hearing granted to those entitled to be heard. We believe that this proposes a fair takeoff on a new economic and political adventure of the first magnitude. While we have taken the price schedule recommended to us by the oil committee, it is with the qualification as already announced, that it is taken subject to any changes found to be necessary on the basis of ascertained facts adduced at open hearings prior to December 1, next.

Since my order of October 16 fixing minimum prices effective on December 1 for crude oil and the principal refined products thereof was promulgated, intimations have come from some of the principal oil-producing states that a few of the operators are proposing to withhold from sale oil out of their current production and allow it to accumulate in the hope of obtaining a higher price for it when this order becomes effective. I express the sincere hope that this will not be done. Such action would disrupt the orderly flow of crude oil to the refineries under present allocations and would inevitably occasion present and future disturbances. The result would be to make more difficult and uncertain the administration of the oil industry. It would impair and perhaps even destroy the benefits sought to be obtained by an orderly administration of the oil industry under the code, interrupting, as it would, the even flow of current production to balance consumptive demand. I confidently appeal to all producers, large and small, to all groups, factions and interests in the industry to give the Government a full measure of co-operation. I urge upon all that we observe not only the letter but the spirit of the code for the good of the industry itself.

Must Work Together

So, gentlemen of the oil industry, you and the Government are going forward shoulder to shoulder in an effort to help your industry serve its own best interests in serving the best interests of the country. May we not hope that a new era has dawned in the history of the oil industry in the United States? It is my earnest desire that we may work together understandingly, sympathetically, intelligently and patriotically for the common good. It goes without saying that the greatest good of the country is also the greatest good of the oil industry. If it is unreasonable from the Nation's point of view to waste a vital and irreplaceable natural resource or to produce it extravagantly it is equally unreasonable from the point of view of the oil industry itself. If conservation is for the good of the country, it is for the good of the oil industry. The more prudently you extract oil from the ground, the more scientifically you manufacture that raw material, the more economically you market it, the better it will be for the country and the better it will be for you. If you waste oil today anywhere along the line from well to consumer you will not have it to sell tomorrow. Gas permitted to evaporate into the air and oil that you fail to recover on account of unscientific methods of extraction add to the cost of the oil without increasing your profits.

We have a common cause to serve. We have a common country that we do not want to leave to the mercy of a possible foe for lack of reasonable conservation of our common resources. We have a mutual interest in assuring national and economic security and in advancing the social welfare of all the people of our country. Here is a new and a most alluring adventure to attract an industry that from the beginning has lived a life of adventure. What more worthwhile undertaking is there in the world today than to contribute your share toward a happier and more economically sound order of society?

The Government pledges to you its good will, gentlemen of the oil industry, in fullest measure. We desire to be of service to you in the common cause. We have no purpose other than to serve the greatest good of the greatest number of people. It is not unreasonable to expect in return full co-operation and willingness to keep rythmic step in our march forward under the oil codes.

Many Retail Problems Arising Under the Code

(Continued from Page 37)

sary before some of the weak spots in the industry's market will be corrected.

Prices

The prevailing tank car price for gasoline under 65 octane is 6¼ cents with scattered quotations both below and above that figure. For the 65 octane material the price is one-fourth cent higher. Some material under 60 octane material has been sold as low as 5¾ cents since the first of the month. This grade material is not regularly offered.

Prices on distillate, gas oil and residual fuel oils have not changed over the past week. All these products are considered strong in tank car and tank wagon markets. Those in touch with this market are predicting higher prices in the event that current production is curtailed. The demand for gas oil and distillates continues heavy but the residual oils for marine and industrial consumption are not so active. The kerosene demand is increasing with supplies for immediate requirements adequate.

Export Business Slow

New export business both for light and heavy oils is slow. There are gasoline inquiries for movement late in the year but so far as known the business has not been placed. Sellers generally are quoting 6 cents at the Gulf Coast for 64-66 375 endpoint gasoline. Prices on other export grades are nominal with no inquiries for open market reported over the past week.

PRELIMINARY INQUIRY ONLY

OTTAWA, Ontario, Oct. 23.—It is understood that the investigation into Canadian gasoline prices, recently authorized by the federal government under the Combines Investigation Act is to be merely a preliminary one, designed to determine whether a more exhaustive investigation is justified. While the parliamentary inquiry of 1932 concerned itself almost solely with whether or not the price charge for gasoline in Canada was fair in relation to costs and company profits, the immediate task is to ascertain whether there exists in Canada any agreement among oil companies to control prices or markets, and if it exists, whether it operates to the detriment of the consumer.

AUTOMOBILE OUTPUT HOLDS UP

WASHINGTON, D. C., Oct. 23.—Bureau of census reports automobile production in September totaled 196,082 units, compared with 200,100 in August, this year, 84,150 in September, 1932, and 140,566 in 1931. Total sales up to October 1 were 1,672,767 this year, compared with 1,155,066 in the nine months of 1932, and 2,119,188 in 1931. Passenger car sales in September, this year, totaled 160,891, trucks 35,182; as compared to 64,735 passenger cars in September, 1932, and 19,402 trucks.

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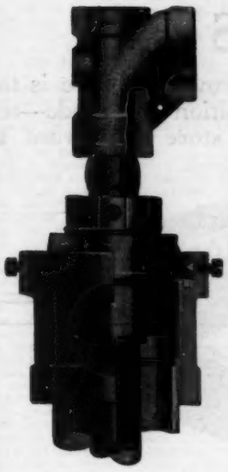

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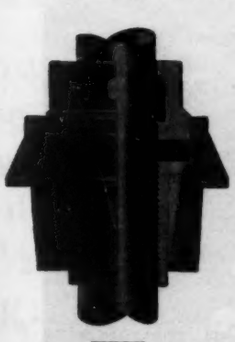

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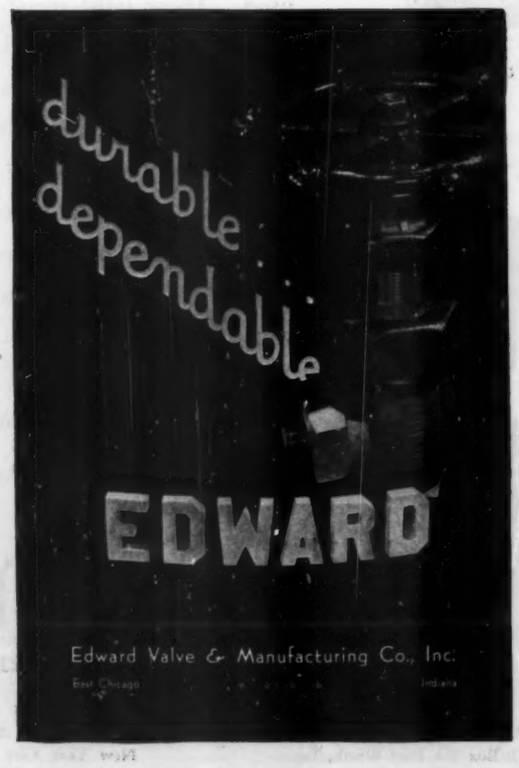


President Byles Says Oil Code Offers Both Opportunity and Responsibility

By AXTELL J. BYLES
President American Petroleum Institute*

Let us assume that five years ago or one year ago we had been asked whether we could have stabilized the industry if we were assured that:

1. Production of crude oil could be balanced with consumer demand for products.

2. A code of fair marketing practices such as we now have would be approved.

3. Agreements within the trade to do almost any sound and constructive thing would be permitted.

4. Indictments for attempting to do these things would be superseded by the encouragement and support of the Government.

Supposing, I repeat, we had then been asked those questions and given those assurances, would we have expressed doubt as to our ability to succeed in spite of the temporary distress, disappointments and sacrifices imposed upon us by the impotence of previous days?

All of these essential things have been given us under the recovery act and the code. They offer opportunity and impose responsibility.

We start, as of October 1 of this year, with a handicap of at least 150,000,000 bbls. excess crude oil in above-ground storage and of approximately 9,800,0 0 bbls. of excess gasoline inventories, which practically reverses the position as to this commodity attained earlier in the year. These inventories cause pressure on the market and should be liquidated in an orderly way and to that extent diminish current production. For instance, in one or two areas, particularly in the interior, the pressure of excessive and accumulating gasoline stocks prevents a realization for gasoline sufficient to justify present crude prices and threatens those prices.

It may be argued that the Government's order of October 16, 1933, fixing minimum prices of crude and products as of December 1, next, solves this problem. I do not believe that it does and hope we will not lose sight of fundamentals in our consideration of detail and adoption of procedure or make hopelessly complex those things that are simple.

The most fundamental thing in economic life is supply. It cannot and will not be ignored. If there is too little to meet consumer demand, price will advance. If there is too much, price will recede. No artifice or agreement or power of government, or any other force, can alter that fact or long avoid its consequences. We should not have to be reminded that the law of supply and demand is inexorable and unchangeable. The state may, within limits, control supply and thus affect price, but price control per se will not for long affect and never will control the law of supply and demand.

If we produce enough crude oil to supply consumer demand for products, less enough to permit modest withdrawals from storage, it will not be possible to overproduce gasoline. Free interchange of crude and gasoline between those who are long and those who are short of these commodities will result; inventories will be liquidated and the oil industry will be prosperous. Confidence once established in the stability of economic quotas of crude oil, willing buyers at fair prices, will appear for both crude and products.

On the other hand, if quotas are set too high, if they are based on the old fallacy of refiner demand, which is speculatively influenced, instead of upon consumer requirements for products; if quotas are inequitably and uneconomically allocated between states and pools, if they are not respected and enforced, chaos, cut-throat competition, waste and bankruptcies are inevitable.

At this point it may properly be asked if any thought has been given to the public in this planned economy. To this we would reply in the affirmative and point out that:

1. According to the U. S. Department of Labor's wholesale price indices, the prices of petroleum and its products in May, 1933, are slightly less than one-third of those prevailing in the recovery administration's key year of 1926. Retail prices of gasoline, excluding taxes, were lower in substantially the same proportion. The August statistics of this year, which are the latest furnished by the department, indicate the prices of petroleum and its products at that time as 40.9 against 48.9 for August, 1932; agriculture, 57.6 as against 49.1 for August, 1932, and all commodities 69.5 as against 65.2 for August, 1932.

2. The oil industry in the past 10 years has paid a tax bill aggregating $3,500,000,000, which exceeds the amount of its profits by $1,000,000,000.

3. Since January, 1929, direct taxes on motor fuel have more than doubled. National, state and direct local taxes have added an average cost of about 4 cents per gallon, yet during that period motorists have actually paid less for gasoline than in previous years. These taxes have been absorbed by the industry and the public has, therefore, been apathetic toward them.

4. It would be difficult to find an industry, the record of which for constantly lowering costs (with the exception of retail marketing) is comparable with that of the oil industry.

5. A sound quota system will prevent price abuse and enlighten self-interest in a mass-production industry, and will prove a deterrent to prices which would curtail consumption.

Proration is sound in theory and, under present conditions, essential in practice. It so far has failed, and made our present state worse than our former, because it has neither been equitably nor scientifically applied nor has it been enforced. Local or temporary balances of situations are of no avail when there is no confidence in their generality or permanency. Once remove the threat of failure and the whole psychology changes. Confidence replaces uncertainty and fear, whereupon our proven reserves and great potentials, vast for the needs of today but meager for the needs of future years, become a stabilizing and reassuring factor instead of a monstrous thing, threatening to destroy an industry while they are destroying themselves.

The test of this control is at hand. Upon its outcome depends the fate of one of the nation's largest industries for a considerable time to come. In this issue is involved not only the prosperity of the industry and its ability to contribute to the prosperity of the country but sound conservation as well.

The vast majority in number and investment in the oil business believes in and is heartily supporting the purposes of the National Recovery Administration and realizes the permanent good which may be derived from certain features of the code. This majority views other features of the code and the procedure thereunder as justified only as emergency measures, which should pass with the termination of the emergency.

*Before A.P.I., Chicago, October 24.

OIL BURNER SHOW IN MARCH

The eleventh annual show and convention of the American Oil Burner Association will be held March 5 to 9, 1934, in the convention hall of the Commercial Museum in Philadelphia, Pa.

East Central Texas Wildcats

(Continued from Page 96)

Bill LaRue et al's No. 1 G. L. Smith, 330 ft. out of NW cor. of G. L. Smith 149-ac. tract, 1 mile SE of Athens, Thomas Helms Sur. ..... Drlg. 3,940 ft.

HUNT COUNTY

Meade and McKennie's No. 1 Love, 300 ft. from N line and 6,390 ft. from W line of 95-ac. tract, John Gilisky Sur. ..... Location.

LEON COUNTY

Shell Petroleum Corp.'s No. 1 Beggs, center of 123.5-ac. tract, John Carter Sur. ..... Coring 5,661 ft.

Standard Oil of Kansas' No. 1 A. W. Johnson, 466 ft. from NE line and 466 ft. from NW line of 100-ac. tract, Simon Sanches Sur. No. 7 ..... Location.

MORRIS COUNTY

Argo and Key's No. 1 Hall, 330 ft. from NW cor. of survey, 3 miles NE of Dangerfield, L. Jordan Sur.... Derrick.

RUSK COUNTY

Arcadia Refining Co.'s No. 2 Griffin and Barnes, 6,950 ft. from S line and 150 ft. from E line of survey, J. B. De Cadena Sur. ..... Swabbing; T.D. 3,686 ft.

George F. Hudson's No. 1-A Phillips, 30 ft. NE of No. 1, 3 miles E of Minden, N. Villareal Sur. ..... Drlg. 1,650 ft.

Hunt Production Co.'s No. 2 B. F. Maxwell, 820 ft. from N line and 2,510 ft. from W line of survey, R. H. Penny Sur. ..... Drlg. 3,593 ft.

Leath and Bateman's No. 1 W. W. Hammett, 250 ft. from S line and 330 ft. from E line of survey, J. H. Sparks Sur. ..... Rig up.

P. & A. Oil Co.'s No. 2 Brightwell, 700 ft. from N line and 1,320 ft. from E line of survey, R. W. Smith Sur. ..... Swabbed salt water; plugged back 22 ft.; T.D. 3,671 ft.

Patterson Drlg. Co.'s No. 3 Brock Estate, 2,320 ft. from N line and 100 ft. from E line of survey, R. W. Smith Sur. ..... Drlg. 2,748 ft.

SMITH COUNTY

Alex McCutcheon's No. 4 Stone, 890 ft. from N line and 940 ft. from W line of survey, D. Shaw Sur. ... Swabbing 3,773 ft.

W. L. Sessions' No. 5 Stone, 1,000 ft. from S line and 910 ft. from W line of survey, D. Shaw Sur. ..... Location.

UPSHUR COUNTY

B. F. Traywick et al's No. 1 M. Vaughn, 330 ft. from S line and 330 ft. from W line of 108-ac. tract, 2 miles NW of Big Sandy, P. B. Standifer Sur. ..... Digging pits.

VAN ZANDT COUNTY

Everett Drilling Co.'s No. 1 J. J. Goode, 1,100 ft. from E line and 330 ft. from N line of lease, W. Rose Sur. ..... Drlg. 2,000 ft.

Gray and Williams et al's No. 1 Paschall, 590 ft. from E line and 200 ft. from N line of 39-ac. tract, 5 miles NW of Jackson, D. Y'Barbo Sur. ..... Set surface csg. 88 ft.

J. O. Griffin's No. 1 Bruce & Gibbard, 1,000 ft. from S line and 330 ft. from E line of 134-ac. tract, G. Martinez Sur. ..... Derrick.

Pure Oil Co.'s No. 5 J. J. Murphree, 250 ft. S of N line and 200 ft. E of W line of J. J. Murphree 82.5-ac. tract, John Walling Sur. ..... Waiting on pumping equipment; T.D. 2,971 ft.

Pure Oil Co.'s No. 3 R. M. Butler, 900 ft. S of N line and 987 ft. W of R. M. Butler 89.16-ac. tract, Davis Rose Sur. ..... Drlg. 1,910 ft.

George Ray et al's No. 1 C. Wilson, 1,100 ft. from S line and 2,420 ft. from W line of 172-ac. tract and survey, 6 miles W of Myrtle Springs, H. Cotes Sur. .. Drlg. 3,100 ft.

Ray Drilling Co.'s No. 1 J. W. Mallory, 1,150 ft. from S line and 150 ft. from W line of 217-ac. tract, John Walling Sur. ..... Derrick.

Wildcat Operations in West Texas

(Continued from Page 94)

Texas-Inland Oil Co.'s No. 1 First National Bank of Hamlin, 590 ft. N and 330 ft. W of SE cor. of W half NE Sec. 191, B.B.B.&C.R.R. Sur. ..... Rig up.

GAINES COUNTY

R. H. Gill et al's No. 1 Crews, 1,320 ft. from S and 1,320 ft. from W line of Sec. 9, Blk. A-20, P.S.L. Sur... Location.

GLASSCOCK COUNTY

Humble Oil & Ref. Co.'s No. 3 Arrington, 330 ft. from N line and 330 ft. from E line of Sec. 21, Blk. 33, Twp. 2s, T.&P. Sur. ..... Location.

Noble Drlg. Co.'s No. 2 Baker, 330 ft. from N line and 330 ft. from E line of Sec. 21, Blk. 33, Twp. 2s, T.&P. Sur. ..... Location.

Schermerhorn Oil Co.'s No. 6 Kloh, 330 ft. from S line and 1,980 ft. from E line of Sec. 13, Blk. 33, Twp. 2s, T.&P.R.R. Sur. ..... Drlg. 2,495 ft.

Tribal Oil Co.'s No. 5-B Edwards, 330 ft. from S line and 330 ft. from E line of Sec. 6, Blk. 33, Twp. 2s, T.&P. Sur. ..... T.D. 620 ft.

H. O. Wootin's No. 2-A W. P. Edwards, 660 ft. from S line and 660 ft. from E line of Sec. 17, T.&P.R.R. Sur., Blk. 33, Twp. 2s ..... Drlg. 1,865 ft.

HOWARD COUNTY

Continental Oil Co.'s No. 4 Eason, 2,310 ft. from S line and 1,884 ft. from W line of Sec. 6, Blk. 32, Twp. 2s, T.&P. Sur. ..... Drlg. 2,335 ft.

Continental Oil Co.'s No. 8 Settles, 1,980 ft. from N line and 1,625 ft. from W line of Sec. 133, Blk. 29, W.&N.W. Sur. ..... Drlg. 2,134 ft.

Donnelly & Norman's No. 1 Magnolia Petroleum Co. (Bell), 330 ft. from N line and 330 ft. from W line of the N half of SW of Sec. 12, T.&P.R.R. Sur., Blk. 30, Twp. 1s ..... S.D. 2,430 ft.

S. B. Dorn et al's No. 1 J. P. Davis, 2,310 ft. from N line and 2,310 ft. from E line of Sec. 2, T&P.R.R. Sur., Blk. 30, Twp. 1s ..... Rig up and S.D.

Group No. 1 Oil Co. and Continental Oil Co., 2,640 ft. from N line and 1,980 ft. from E line of Sec. 5, T.&P.R.R. Sur., Blk. 32 ..... Spudding 40 ft.

L. C. Harrison et al's No. 2 Texas Land & Mortgage Co. 2,310 ft. from E line and 330 ft. from the S line of Sec. 4, T.&P.R.R. Sur., Blk. 30, Twp. 1s ..... Location

Plymouth Oil Co.'s No. 9 Kloh et al, 2,640 ft. from the N. line and 1,980 ft. from W line of Sec. 5, Blk. 32, T.&P.R.R. Sur., Twp. 2s ..... Location.

Joe Rusk et al's No. 2 G. M. Dodge Estate, 330 ft. from N line and 2,310 ft. from the E line of Sec. 9, H.&T.C.R.R. Sur., Blk. 30, Twp. 2s ..... Cellar and pit.

Sinclair Prairie Oil Co.'s No. 9 Dodge, 310 ft. from N line and 1,625 ft. from W line of Sec. 11, Blk. 30, Twp. 1s, T.&P.R.R. Sur. ..... Bldg. derrick.

Southern Oil Co.'s No. 1 Denman, 2,310 ft. from N line and 330 ft. from W line of Sec. 10, Blk. 30, Twp. 1s, T.&P.R.R. Sur. ..... Bldg. derrick.

Southern Oil Co.'s No. 1 Denman, 1,650 ft. from N line and 330 ft. from W line of Sec. 14, Blk. 30, Twp. 1s, T.&P.R.R. Sur. ..... Bldg. derrick.

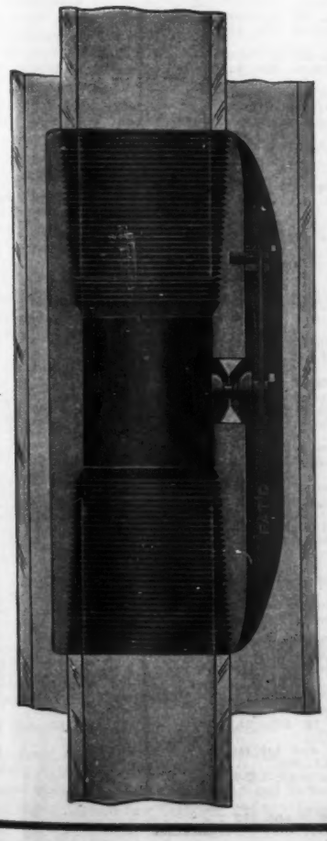
Ungren & Frazier's No. 1 Davis, 330 ft. from S line and 990 ft. from W line of Sec. 2, Blk. 30, Twp. 1s, T.&P. Sur. ..... Drlg. 560 ft.

IRION COUNTY

R. D. Covington's No. 1 Mitchell, 150 ft. from S line and 150 ft. from W line of Sec. 724, C. Wimsch Sur. ..... Running csg. 1,282 ft.

Perry Fox's No. 1 Resch, 170 ft. E and 450 ft. S of the most southerly NW cor. of Sec. 1,026, H.E.&W.T. Sur. ..... Drlg. 745 ft.

To A. P. I. *Specifications—*



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JONES COUNTY

Dyer's No. 1 Odom, 300 ft. from S and 170 ft. from W of N 320 acres, G. Zumwalt Sur. ..... T.D. 2,040 ft.
Reeser & Pendleton's No. 1 W. H. Evans, 300 ft. N and 9,300 ft. E of SW cor. of E 101 acres of N 202 acres of Sec. 4, Blk. 15, T.&P.R.R. Sur. ..... Drlg. 720 ft.

LOVING COUNTY

R. L. Allen's No. 1 fee, 4,290 ft. from NE line, 330 ft. from SE line, Sec. 82, H.&T.C. Sur. ..... Location.
R. L. Allen's No. 2 fee, 4,290 ft. from NE line, 990 ft. from SE line, Sec. 82, Blk. 33, H.&T.C. Sur. ..... Location.
R. L. Allen's No. 3 fee, 4,290 ft. from NE line, 990 ft. from NW line, Sec. 82, Blk. 33, H.&T.C. Sur. ..... Location.
R. L. Allen's No. 4 fee, 4,290 ft. from NE line, 330 ft. from NW line, Sec. 82, Blk. 33, H.&T.C. Sur. ..... Location.
Eppenauer Drlg. Co.'s No. 1-C Allen, 330 ft. from NW line, 2,310 ft. from SW line, Sec. 90, Blk. 1, W.& NW Sur. ..... Location.
Eppenauer Drlg. Co.'s No. 1-A Victor, 330 ft. from SW and 335 ft. from SE of NW of N half Sec. 4, Blk. 2, W.&N.W. Sur. ..... Rigging up standard tools.

PECOS COUNTY

Mac T. Anderson's No. 1 E. M. Roots Estate, 2,500 ft. from the N line and 330 ft. from W line of Sec. 11, G.C.&S.F.R.R. Sur., Blk. 118 ..... Location.
M. E. Black et al's No. 1 E. E. Powell et al, 150 ft. from NE line and 150 ft. from SE line of Sec. 102, H.&G.N.R.R. Sur., Blk. 10 ..... Running csg. 149 ft.
M. D. Bryant's No. 1 Robertson, 375 ft. S and 150 ft. E from NW cor. of Robertson Sur. (this well is east offset to Mid-Kansas Oil & Gas Co.'s No. 23 Smith-Taylor) ..... Drlg. 1,089 ft.
Culberson Bros.'s No. 15-B Monroe, 725 ft. from N line and 1,380 ft. from E line of Sec. 39, Blk. 194, G.C.&S.F.R.R. Sur. ..... Location.
Easter-McCurdy's No. 1-A Smith, 840 ft. from S line and 1,030 ft. from E line of Sec. 27, Blk. 149, G.C.&S.F. Sur. ..... Location.
Humble Oil & Refining Co.'s No. 1 White, Baker, 1,320 ft. from N and E lines of Sec. 44, Blk. Z, T.C. Sur. ..... Drlg. 5,301 ft.
Kemper & Kimberlin et al's No. 2 D. B. Gregg et al, 2,490 ft. from NW line and 1,470 ft. from NE line of Sec. 101, H.&G.N.R.R. Co. Sur., Blk. 10 ..... Location.
Mid-Kansas O. & G. Co.'s No. 15 Smith-Taylor, 1,296 ft. from S line, 1,390 ft. from W line, Sec. 33, G. C.&S.F. Sur., Blk. 194 ..... Location.
Mid-Kansas Oil & Gas Co.'s No. 21 Smith-Taylor, 1,700 ft. from S line and 275 ft. W of northerly NW cor. of Fred Turner, Jr., Sur., but located in Sec. 33, Blk. 194, G.C.&S.F. Sur. ..... Est. 74,000,000 ft. of gas; T.D. 1,254 ft.
Mid-Kansas Oil & Gas Co.'s No. 22 Smith-Taylor, 250 ft. from S line and 324 ft. from W line of NW cor. of Fred Turner, Jr., Sur. No. 2, but located in Sec. 33, Blk. 194, G.C.&S.F. Sur. ..... Running csg. 1,075 ft.
Mid-Kansas Oil & Gas Co.'s No. 23 Smith-Taylor, 332 ft. S of N line of Sec. 33 and 160 ft. from W line of Robertson Sur., Sec. 33, Blk. 194, G.C.&S.F.R.R. Sur. ..... Est. 70,000,000 ft. of gas; T.D. 1,100 ft.
Mid-Kansas Oil & Gas Co.'s No. 32-A I. G. Yates, 205 ft. from N line and 250 ft. from W line of NW cor. of Fred Turner, Jr., Sur. No. 3, but located in I. G. Yates Sur., A-8195 ..... S.D. 1,629 ft.
Mid-Kansas Oil & Gas Co.'s No. 35-A, 250 ft. from N line and 324 ft. from E line of NW cor. of Fred Turner, Jr., Sur. No. 2, but located in I. G. Yates Sur., A-8195. ..... Drlg. 518 ft.
Sproles & O'Neal's (rec.) No. 2-A Fred Turner, Jr., 196 ft. from N line, 900 ft. from W line of Fred Turner, Jr., Sur. No. 1 ..... Location.

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Sproles & O'Neal's (rec.) No. 4-A Fred Turner, Jr., 1,640 ft. from N line, 250 ft. from W line of Fred Turner, Jr., Sur. No. 1 ..... Est. 10,000,000 ft. of gas; T.D. 1,080 ft.
Sproles & O'Neal's (rec.) No. 5-A Fred Turner, Jr., 250 ft. from N, 250 ft. from W of C SE cor. of Fred Turner, Jr., Sur. No. 1 ..... Location.
Sproles & O'Neal's No. 7-A Fred Turner, 250 ft. from S line, 250 ft. from W line of Fred Turner, Jr., Sur. No. 1 ..... Location.
Sproles & O'Neal's No. 8-A Fred Turner, Jr., 560 ft. from S line, 550 ft. from E line of Fred Turner Jr., Sur. ..... Location.
Sproles & O'Neal's No. 1-B Fred Turner, Jr., 250 ft. from N line, 305 ft. from E line of Fred Turner, Jr., Sur. ..... Flowed 1,920 bbls. per hour; T.D. 1,428 ft.
Sproles & O'Neal's No. 2-B Fred Turner, Jr., 250 ft. from N line, 305 ft. from W line of Fred Turner, Jr., Sur. ..... Drlg. 1,345 ft.
Sproles & O'Neal's No. 3-B Fred Turner, Jr., 250 ft. from S line, 250 ft. from W line of Fred Turner, Jr., Sur. ..... Location.
Sproles & O'Neal's No. 4-B Fred Turner, Jr., 717 ft. from S line, 250 ft. from E line of Fred Turner, Jr., Sur. No. 2 ..... Location.
Sproles & O'Neal's No. 1-C Fred Turner, 250 ft. from N line, 250 ft. from W line of Fred Turner, Jr., Sur. ..... Location.
Sproles & O'Neal's No. 2-C Fred Turner, Jr., 205 ft. from N line, 305 ft. from E line of Fred Turner, Jr., Sur. No. 3 ..... S.D. 1,493 ft.
Trans-Texas Oil Co.'s No. 1 C. M. Anderson, 330 ft. from the S line and 330 ft. from the E line of Sec. 27, Blk. 50, Twp. 9, T.&P.R.R. Sur. ..... Location.

REAGAN COUNTY

Big Lake Oil Co.'s No. 12-C University, 925 ft. from N, 740 ft. from E line of Sec. 12, Blk. 3, University land ..... Drlg. 3,377 ft.
Big Lake Oil Co.'s No. 14-C University, 725 ft. from S line and 2,730 ft. from E line of Sec. 25, Blk. 9, University Land Sur. ..... Bldg. derrick.
Big Lake Oil Co.'s No. 15-C University, 660 ft. from E line and 660 ft. from S line of Sec. 25, Blk. 9, University Land Sur. ..... Rig up.
Continental Oil Co.'s No. 9-B University, 1,900 ft. from S line, 1,805 ft. W of E line of Sec. 39, Blk. 9, University Land Sur. ..... Drlg. 8,543 ft.

RUNNELS COUNTY

Agnew et al's No. 1 H. B. Fowler, 150 ft. S and W of NE cor. of Sec. 23, N. Travis Sur. No. 533 ..... Drlg. 600 ft.
Golden Pet. Co.'s No. 2 McMillan, Subdv. 22, N. Travis Sur. ..... Moving in material.
B. C. Mann et al's No. 1 H. E. Wade, 150 ft. from S and 1,650 ft. from W line, Subdv. No. 8, Norvel Travis Sur. No. 533 ..... Drlg. 815 ft.

UPTON COUNTY

Gulf Prod. Co.'s No. 103 McElroy, 1,980 ft. from S and 660 ft. from W, Sec. 197, Blk. F, C.C.S.D.&R.G.N.G. ..... Drlg. 7,357 ft.

WARD COUNTY

Abell Brothers' No. 1 Archenhold et al, 2,310 ft. from NE line and 330 ft. from SE line of Sec. 21, H.&T.C. Sur., Blk. 5 ..... Drlg. 2,212 ft.
Atlantic Oil & Prod. Co.'s No. 3 Blank-Camp, 2,310 ft. from NW line and 2,310 ft. from SW line of Sec. 14, Blk. 34, H.&T.C. Sur. ..... Location.
Atlantic Oil & Prod. Co.'s No. 4 W. D. Johnson, 330 ft. from NE line and 990 ft. from SE line of NE half of Sec. 9, H.&T.C. Sur., Blk. 34 ..... Running csg. 2,360 ft.
Atlantic Oil & Prod. Co.'s No. 9 Johnson, 330 ft. from NE line and 990 ft. from NW line of Sec. 9, Blk. 34, H.&T.C. Sur. ..... T.D. 1,491 ft.
Atlantic Oil & Prod. Co.'s No. 10 Johnson, 990 ft. from NE line and 330 ft. from NW line of Sec. 9, Blk. 34, H.&T.C. Sur. ..... Location.
Atlantic Oil & Prod. Co.'s No. 11 Johnson, 2,310 ft. from NE line and 1,650 ft. from SE line of Sec. 9, Blk. 34, H.&T.C. Sur. ..... Location.
Atlantic Oil & Prod. Co.'s No. 12 Johnson, 990 ft. from SE line and 990 ft. from NE line of Sec. 9, Blk. 34, H.&T.C. Sur. ..... Location.
Atlantic Oil & Prod. Co.'s No. 13 Johnson, 330 ft. from NE line and 330 ft. from SE line of Sec. 9, Blk. 34, H.&T.C. Sur. ..... Location.
Atlantic Oil & Prod. Co.'s No. 14 Johnson, 330 ft. from NE line and 2,310 ft. from NW line of Sec. 9, Blk. 34, H.&T.C. Sur. ..... Location.
Atlantic Oil & Prod. Co.'s No. 15 Johnson, 330 ft. from SE line and 1,650 ft. from NE line of Sec. 9, Blk. 34, H.&T.C. Sur. ..... Location.
George Bentley et al's No. 1 C. Bergman, 330 ft. from NE line and 2,310 ft. from NW lines of Sec. 26, Blk. 5, H.&T.C. Sur. ..... T.D. 2,650 ft., plugged back to 2,470 ft., fishing.
George Bentley et al's No. 1 A. Emory, 1,830 ft. from NE line and 2,310 ft. from NW line of Sec. 36, Blk. 5, H.&T.C. Sur. ..... T.D. 2,301 ft.
California Oil Co.'s No. 1 J. F. York, 330 ft. from NW line and 330 ft. from SW line of Sec. 10, Blk. 34, H.&T.C. Sur. ..... Drlg. 811 ft.
Eastland Oil Co.'s No. 2 Johnson, 1,980 ft. from SE line and 1,980 ft. from SW line of Sec. 24, Blk. 34, H.&T.C. Sur. ..... Drlg. 1,500 ft.
Eppenauer Drlg. Co.'s No. 1 University, 330 ft. from N and 440 ft. from E of S half of Blk. 16 ..... Drlg. 2,720 ft.
Gulf Prod. Co.'s No. 22 Hutchings, 330 ft. from N line and 330 ft. from W line of Sec. 4, Blk. F, G.M.M. B.&A. Sur. ..... Drlg. 2,370 ft.
Gulf Prod. Co.'s No. 27 O'Brien, 990 ft. from N line and 330 ft. from E line of Sec. 17, Blk. F, G.&M.M.B.&A. Sur. ..... Drlg. 410 ft.
Gulf Prod. Co.'s No. 36 O'Brien, 330 ft. from N line and 330 ft. from E line of Sec. 17, Blk. F, G.M.M.B.&A. Sur. ..... Drlg. 2,480 ft.
Gulf Prod. Co.'s No. 38 O'Brien, 990 ft. from S line and 990 ft. from E line of Sec. 16, Blk. F, G.&M.M. B.&A. Sur. ..... Location.
Jack Leidecker et al's No. 1 A. Archenhold et al, 2,310 ft. from NE and 2,310 ft. from NW line of Sec. 23, H.&T.C.R.R. Sur., Blk. 5 ..... Drlg. 3,018 ft.
Simms Oil Co.'s No. 1 Massey, 2,310 ft. from SW line and 2,310 ft. from SE line of Sec. 14, Blk. 34, H.&T.C. Sur. ..... Location.
Sinclair Prairie Oil Co.'s No. 2 H. Archenhold, 330 ft. from NE lines and 330 ft. from SE lines of SW of Sec. 22, H.&T.C. Sur., Blk. 5 ..... Drlg. 375 ft.

WINKLER COUNTY

Harry Adams et al's No. 3 Scarborough, 990 ft. from N line and 990 ft. from E line of Sec. 1, Blk. 77, P.S.L. Sur. ..... Swabbing and cleaning out; est. 50 bbls. day; T.D. 2,188 ft.
Richardson et al's No. 1-D Scarborough, 990 ft. from N line and 1,650 ft. from E line of Sec. 18, Blk. 74, P.S.L. Sur. ..... Rig up.
Richardson et al's No. 2 State, 102.5 ft. N and 330 ft. E from the NW cor. Sec. 1, Blk. 77, P.S.L. Sur. ..... S.D. 2,569 ft.
Sinclair Prairie Oil Co.'s No. 3 W. F. Scarborough, 1,650 ft. from E line and 1,980 ft. from N line of Sec. 1, Blk. 17, P.S.L. Sur. ..... Location.
L. H. Wentz' No. 1 Dougherty, 330 ft. from N and 330 ft. W of Sec. 2, Blk. C-24, P.S.L. Sur. ..... Location.

Oklahoma Will Be Well Within Allowable for October; Will Make Up Old Overage

By JAMES McINTYRE

Secretary Ickes has been assured by the Oklahoma Corporation Commission that Oklahoma will be within the allowable production set by the oil administration, but that it must not be expected each week's figures will show a production under the average daily allowable.

It is said that the Oklahoma City production in October will be more than 4,000 bbls. per day under the October allowable and the commission has assured the Secretary of the Interior that whatever overage there was in September will be made up in November.

Basing his figures on the weekly average estimates, Secretary Ickes wired the commission that from September 9 to 23 Oklahoma was 400,000 bbls. overproduced; that in the last week in September this was reduced to 356,000 bbls. and that at the end of the first week in October it was further reduced to an overage of 242,000 bbls. The head of the oil administration asked that this be made up in October.

Acting Chairman Hughes of the commission replied that it was impossible to get official production figures for September until October 20, and that October production figures were not available until November 20.

Mr. Hughes asked that the production for any one week not to be taken as a criterion, because daily production varies considerably. The figures covering a whole month would tell a more accurate story, he said. Mr. Hughes assured the oil administration head that September overage would be made up in November. He received a telegram thanking the commission for its co-operation and authorizing it to make up the September overage as suggested by Commissioner Hughes.

The commission and Umpire Armstrong and his staff are bending every effort to keep Oklahoma inside the Government's permitted production. This State has always co-operated with curtailment movements, and has the best record of the three big producing states in this regard. California has done very well when it is considered that it had no state governing body with authority to compel producers to keep within the allowable. The Texas oil regions have also played the game fairly, excepting in East Texas, which has been a thorn in the side ever since it began to be a large producing field.

Production by Pools

Estimated daily average production in Oklahoma in the week ending October 21 and in the preceding week follows:

	Bbls.	
	Oct. 21	Oct. 14
Allen	9,590	10,085
Bowlegs	11,010	11,205
Bristow-Slick	11,100	11,100
Healdton	9,900	9,900
Hewitt	5,100	5,100
Burbank	9,300	9,400
Locke	7,580	9,445
Carr City	6,150	6,995
Cromwell	4,900	4,950
Earlsboro	9,300	10,870
East Earlsboro	14,160	15,165
South Earlsboro	1,100	1,700
Little River	15,170	17,145
East Little River	900	960
Oklahoma City	211,520	180,110
Seminole City	9,185	11,325
East Seminole	1,195	1,565
Searight	2,295	2,710
Maud	1,650	1,640
Mission	4,720	4,870
Cushing-Shamrock	15,300	13,300
St. Louis-Pearson	19,720	26,630
Tatums-Tussey	7,850	7,750
Sholem-Alechem	5,200	5,350
Other pools	127,925	127,970
Total Oklahoma	519,320	507,240

News from the Oklahoma fields in the past week failed to include any important new strikes, or any unusually big wells. Neither Lucien nor Crescent Pools, just now the most interesting new areas in the State, had much of interest to offer the oil man.

In the Crescent Pool

Gypsy Oil Co. and Carter Oil Co.'s No. 1 Walker, C NE NE Section 33-17-4w, in the Crescent Pool, Logan County, was given several tests in the past week. It flowed 1,824 bbls. in 24 hours, with 3,000,000 feet of gas; then 2,481 bbls. in 24 hours with 4,000,000 feet of gas and about 3 per cent water; then 2,517 bbls. in 21 hours, one-half of 1 per cent water, and 5,000,000 feet of gas.

The Mid-Continent Petroleum Corp. has rig on the ground for No. 1 Campbell, C SE NE Section 33-17-4w, and the Texas Co. has cellar dug for No. 1 Denny, C NE SE Section 33-17-4w.

Oklahoma County

W. E. Huston and others' No. 1 Ketchum, Section 32-14-3w, in the Edmund district, Oklahoma County, drilled to 6,853 feet and plugged back to 6,748 feet and the crew was waiting for cement to set. This well had Wilcox sand at 6,765 feet and took three cores down to 6,827 feet, with no oil showing.

H. E. Rapp and others' No. 1 Price, C E half NE SW Section 19-14-3w, after running 6,600 feet of 2½-inch tubing, began swabbing, but lost the swab in the tubing. The well flowed through the casing 25 bbls. in 30 minutes. The tubing was pulled and rerun with 5-inch kick-off collars and the crew resumed the test.

In the Oklahoma City Field Pierce and others' No. 1 Shepard, C NE NW SE Section 15-11-3w, flowed 1,743 bbls. in eight hours, with gas at the rate of 23,000,000 feet.

Murray, Stephens and others' No. 1 Anderson, 354 feet south and 823 feet east of C Section 15-11-3w, flowed 2,725 bbls. in a four-hour test and was shut in.

Gulf Production Co. of Oklahoma's No. 5 Medders, 1,105 feet south and 105 feet east of C Section 22-11-3w, tested 2,942 bbls. in four hours, with gas at the rate of 15,000,000 feet per day.

Indian Territory Illuminating Oil Co.'s No. 2 South Glendale, SW NW NW Section 26-11-3w, made 1,694 bbls. in a four-hour test with 47,600,000 feet of gas per day, and the same company's No. 2 Wickline, SE SW NW Section 26-11-3w, flowed 1,911 bbls. in four hours, with gas at the rate of 24,900,000 feet per day. Same company's No. 5 Little, SE NE NE Section 27-11-3w, flowed 1,018 bbls. in two hours from sand at 6,502 feet, total depth 6,632 feet. It showed a 20,000,000-foot gas production. No. 6 on the same lease was ready to be drilled in at a total depth of 6,566 feet.

Lincoln County

West of Chandler in Lincoln County Stanolind Oil & Gas Co. is getting ready to start a test, No. 1 Simpson, NE NW Section 11-14-3. In the same section Amerada Petroleum Corp. and Stanolind Oil & Gas Co. were drilling at 4,125 feet in No. 1 Brill, NW NE Section 11, and Magnolia Petroleum Co. is drilling below 3,160 feet in No. 1 Rice, NW SW NE Section 11. Magnolia Petroleum Co. was rigged up on No. 3 Benedict, SW SE NW Section 7-14-4, and Slick Estate and others had made location for No. 5 fee, NW NE SW Section 7-14-4. Magnolia Petroleum Co. had rigged up a rotary for No. 1 Green, NE cor. Section 18-14-4, and the same company was rigged up but shut down on No. 2 Wagner, NW NE NE Section 18-14-4.

Huckleberry and others were moving in to start No. 1 Boland, SW cor. Section 25-12-3, a wildcat in southwestern Lincoln County.

Greater Seminole Field

In the Keokuk Falls area in Seminole County, Carter Oil Co. and others were building rig for No. 1 Cossey, a community test, C W half SE NE Section 23-11-6, and have made a location for No. 2 Canard, C S half SE SW Section 23-11-6e. The same operators' No. 1 Riddle, C S half SE SE Section 35-11-6 was acidized in Hunton lime and made 950 bbls. in 24 hours. It had made 124 bbls. naturally from the pay at 4,083-08 feet.

In the southern part of the Keokuk Falls area Carter Oil Co. and others' No. 1 Renton, also a community operation, C N half NE NW Section 2-10-6, made 835 bbls. in one-day and 617 bbls. on another day from Misener sand topped at 4,112 feet and tubing was being run. Same operators have made location for No. 1 Timmy, C N half NE NE Section 2-10-6.

In the South St. Louis area the Amerada Petroleum Corp. drilled deeper in No. 1 Harrison, NW SW Section 33-7-4, from 4,136-4,205 feet and the well swabbed 1,072 bbls. of oil and 162 bbls.

Wildcat Operations in Oklahoma

Week Ending October 21

Northern Oklahoma

ALFALFA COUNTY

Company, farm and location— Remarks:

Acre et al's No. 1 Acre, C SW NE Sec. 14-24-11w.....C.O.; T.D. 6,196 ft.

BECKHAM COUNTY

Mid-Texas' No. 1 Sidell, SE SW SW Sec. 17-9-22w.....Drlg. plug; T.D. 2,780 ft.

Pattee Royalty Co.'s No. 1 Goose Tree, SW SE SW SE Sec. 23-10-25w .....T.D. 3,965 ft.

COAL COUNTY

Funk & Russell's No. 1 Miller, SE NE Sec. 10-2-5 .....S.D. 2,750 ft.

GARFIELD COUNTY

J. H. Lewis' No. 1 Clark, C NW NW Sec. 34-21-4w .....Drlg. 5,293 ft.

GREER COUNTY

Otis Cosgrove's No. 1 Border, C S½ NE NW Sec. 31-6-22w. Drlg. 50 ft.

HUGHES COUNTY

Dixie-Lee Oil Co.'s No. 1 Taylor, C NW Sec. 27-4-10.... Drlg. 350 ft.

Scruggs et al's No. 1 Black, NE Sec. 12-9-10 .....Set pipe at 460 ft.; C.O.

KAY COUNTY

Morgan et al's No. 1 Bush, NW NE NE Sec. 25-28-4....S.D. 2,695 ft. for pipe.

Burton Lewright et al's No. 1 Leseman, SW NE SE Sec. 4-28-3 .....Rig.

KIOWA COUNTY

Christian's No. 1 Jones, NE NW Sec. 3-7-15w .....Drlg. on iron at 1,856 ft.

LINCOLN COUNTY

Amerada Pet. and Stanolind O. & G. Co.'s No. 1 Martinek, NW SE Sec. 35-13-5e .....Drlg. 3,422 ft.

Amerada Pet. Co.'s No. 1 Long, C NW NW SW Sec. 13-13-4 .....Plugging back.

Huckleberry et al's No. 1 Boland, SW cor. Sec. 25-12-3e..Moving in.

MARSHALL COUNTY

Robb et al's No. 1 Vittitoe, NE SE Sec. 11-5s-4e..... S.D. 3,315 ft. for fuel.

MURRAY COUNTY

A. E. Harden's No. 1 Sadler, NE Sec. 19-1-2.....Rig.

T. E. Revells et al's No. 1 Wolfe, NE cor. Sec. 18-1-2.. U.R. 10-in. pipe; T.D. 1,300 ft.

MUSKOGEE COUNTY

J. S. Routt et al's No. 1 Essee, CWL SE NE Sec. 17-13-17 T.D. 1,200 ft.; S.D. for 10-in. csg.

OKLAHOMA COUNTY

Houston et al's No. 1 Ketchum, CSL NW NE SE Sec. 32-14-3w .....Drlg. 6,827 ft.

Mid-Continental Oil Co.'s No. 1 Edwards, C SE SE Sec. 19-11-1 .....S.G. 3,160-80 ft.; S.D. 3,341 ft.

H. E. Rapp's No. 1 Price, CSL NE SW Sec. 19-14-3w....Re-run tubing; will test; T.D. 6,798 ft.

F. Russell's No. 1 Heaplay, SW NW NE Sec. 33-13-3w..Wilcox sand 6,649-59 ft.; 347 bbls. in 24 hrs.; rigging up standard tools.

PAYNE COUNTY

O. N. Maines et al's No. 1 Scheidberg, NW SW NW Sec. 17-19-4 .....Wilcox sand 3,114-38 ft; wtr.; S.D.

PITTSBURG COUNTY

Haley et al's No. 1 Walkerson, NW cor. Sec. 9-2-16 ....T.D. 200 ft.; S.D.

Moffett & Hall's No. 1 Jones, C NE NW Sec. 14-8-14 ..Broken sand 3,100-3,200 ft.; fishing for tools.

POTTOTOC COUNTY

Galbreath's No. 1 Stafford, NE SE SE Sec. 31-3-6.....S.D. 870 ft.

Choctaw O. & G. Co.'s No. 1 Thompson, SW NE SW Sec. 1-1-7 .....S.D. 1,680 ft.

W. E. McGraw's No. 1 Mayhue, NE Sec. 19-3-6 .....S.D. 1,200 ft.

McGee et al's No. 1 Newborn, SW NE Sec. 31-5-4.....Rig.

Williams' No. 1 Kroth, NE SE Sec. 23-3-4.....H.F.W. 1,977 ft.

Wirrick's No. 1 fee, SE SW Sec. 29-3-7 .....Acidized; flowed 550 bbls. in 24 hrs.; S.D. for tankage.

POTTAWATOMIE COUNTY

Atlantic Oil Prod. Co.'s No. 1 School land, C NE NW NW Sec. 36-10-4 .....Drlg. 2,430 ft.

Conley Drlg. Co.'s No. 1 Vinson, NE cor. Sec. 13-7-4e....S.D. 2,794 ft.

Payne Drlg. Co.'s No. 1 Lovelace, NW SW NW Sec. 27-6-4 T.D. 3,780 ft.; csg. collapsed.

Vivian Oil Co.'s No. 1 Kanster, SE SW Sec. 18-7-4.....Set 6-in. pipe 3,926 ft; W.O.C.S.

SEMINOLE COUNTY

Huffman Drlg. Co.'s No. 1 Scott, NW cor. SE .....Abd.

Stewart & Egan's No. 1 Sanderson, NE SW Sec. 27-4-5..H.F.W. 3,740 ft.; P.B. to 3,724 ft.

WASHITA COUNTY

McWhirter & Bost's No. 1 Hall, SW SE SE Sec. 18-8-19w. Drlg. 180 ft.

Southern Oklahoma

ATOKA COUNTY

J. D. Boukan's No. 1 Howard, NW SW NW Sec. 20-2s-10e. S.D. for pipe 682 ft.

Blake's No. 1 Galbreath, SW NE SE Sec. 5-1-15 .....S.D. 248 ft.

Maiernes et al's No. 1 Cole, NE NW Sec. 19-2s-14.....S.D. 638 ft.

JEFFERSON COUNTY

Wakefield's No. 1 Kelly, NW SE Sec. 1-5s-8w..... Drlg. 550 ft.

STEPHENS COUNTY

J. W. Madison's No. 1 Tussey, SW SE NW Sec. 24-1n-4w. T.D. 1,680 ft.; S.D. for wtr.

Navajo Oil Co.'s No. 1 Miller, NW cor. NE Sec. 13-1n-6w. Drlg. 1,065 ft.

R. T. Poland et al's No. 1 Green, C NE NW NW Sec. 8-1s-4w .....Rig on ground.

TILLMAN COUNTY

J. H. Everett's No. 1 Crane, SW cor. Sec. 15-3s-14w... Rig.

MAJOR COUNTY

Paul R. Robb's No. 1 Vittitoe, C NE SE Sec. 11-5-4.....S.D. 3,500 ft.

of water in 24 hours. Later it made 758 bbls. of oil and 150 bbls. of water in 24 hours. It was completed.

Mid-Continent Petroleum Corp.'s No. 2 Vieux, SE SW SE Section 31-7-5, was drilled to a pay 4,090-95 feet and the well swabbed 420 bbls. of oil and some water. Top of the Simpson was found at 3,952 feet.

In the West Holdenville Field, Troup & O'Connor's No. 4 Haskett, C S half SW SE Section 15-7-8, made a 60-bbl. pumper in Calvin sand at 1,181-1,204 feet.

Winona Oil Co. and Jarvis & Holm's No. 1 Campbell, 330 ft. north and 1,180 feet east of SW cor. Section 20-7-8, was completed after it had swabbed and flowed 750 bbls. in 48 hours. It is producing from dolomite at 4,218-36 feet. Maynard and others' No. 4 Moore, C N half NW NE Section 22-7-8, is a 50-bbl. Calvin sand well. 1,182-86 feet.

Amerada Petroleum Corp. will plug back in No. 2 Fullerton, NE SE Section 19-9-6, Seminole City Pool, to test Calvin sand. Banta and others have rigged up No. 1 Harjo, NW NE Section 36-9-6; Stanolind Oil & Gas Co. will plug back to Calvin sand in No. 1 Jones, NW SE NW, Section 20-9-6. Indian Territory Illuminating Co. will plug back to Hunton lime in No. 1 Allen, SW SE Section 25-9-6. Charles Liddell was drilling at 330 feet in No. 1 Brandenburg. SE SW SW Section 2-7-4. Keyokla Petroleum Co.'s No. 1 McGee, SE SW SE Section 4-7-4, was drilling at 122 feet. Hall & Briscoe have rig on the ground for No. 4 Brown, NE SW NW Section 33-7-4. Locations have been made for Stauffer Drilling Co.'s No. 1, NW cor., Section 5-7-4; Amerada Petroleum Corp.'s No. 2, SE NE SE Section 32-7-4; Stauffer Drilling Co.'s No. 1, SE cor. Section 31-8-4; Pitney and others' No. 1, C SW NE NW Section 6-7-4; Phillips Petroleum Co.'s No. 2, C SW SW SE Section 35-7-4 (cellar dug); Mid-Continent Petroleum Corp.'s No. 5, SW NW SE, and Pure Oil Co.'s No. 1, C NW NW SE Section 22-7-8.

Phillips Petroleum Co.'s No. 7 Fixico, C NW SW NW Section 20-9-6, had sand at 2,728-45 and 2,755-80 feet. Intermittent swabbing brought up 40 bbls. of oil and 140 bbls. of water in the course of 12 hours.

Creek County

In the Mannford district, Creek County, Big Four Petroleum Co.'s No. 2 McIntosh, SE SW SE Section 34-19-8, was deepened to Red Fork sand at 2,622-46 feet, shot with 100 quarts, and made a 45-bbl. initial producer.

Johnson Oil & Refining Co.'s No. 4, CNL NE SE Section 19-19-10, is a 10-bbl. well in Red Fork sand at 2,086-2,112 feet, after a shot.

In the Layton sand pool in the Olive district, L. B. Jackson's No. 6 Wills, CSL SW NW Section 26-18-8, was completed as a 15-bbl. well. F. O. Akin's No. 1 Howard, NE NW SE Section 34-18-8, was completed after it had made a 155-bbl. flowing test. Doss and others' No. 1 Tiger, SE NW NE Section 34-18-8, also previously reported, was completed after flowing 210 bbls. in 24 hours. C. W. Titus' No. 1 Sena, NW NE NE Section 10-17-8, was completed as a 25-bbl. well. Aside from the finishing up of these wells all of which had been reported in their incompleted stage, there were no results in this pool.

F. O. Akin has a machine in for No. 3 Howard, SW NW SE Section 34-18-8. Bay State Oil Co. was drilling at 350 feet in No. 2 Crabtree, SE NE SW Section 34-18-8, and Doke & Hughes were drilling at 585 feet in No. 1 E. Rentie, NW SW SE Section 34-18-8. Todd & Willoughby's No. 2, SE NW Section 34-18-8, was spudded in; Texas Co.'s No. 1 Harry and A. A. Bailey's No. 1 Harjo, NE NW NE, Section 12-16-9, locations.

Osage County

The Indian Territory Illuminating Oil Co. and Palmer's test, C NE NE NW Section 8-25-6, in Osage County, which was reported last week to have swabbed 35 bbls. in five hours was put on the pump and made 65 bbls. in 12 hours and then sanded up. It is producing from sand at 2,846-63 feet.

Lewis Production Co.'s No. 1, SE cor. NW Section 21-24-7, in the Naval Reserve area, flowed 505 bbls. of oil the first 24 hours. Later it flowed 167 bbls. in 24 hours and will be shot. It produces from the Bartlesville sand at 2,635-63 feet.

The Gypsy Oil Co. and Continental Oil Co.'s No. 1, NE cor. Section 14-23-7, was acidized in Hominy sand at 2,832-89 feet. When opened up it flowed 20 bbls. in 20 minutes and then went dead. It was being cleaned out.

Norbla Oil Co.'s No. 1, SW cor. NE Section 20-23-9, made a flow of 150 bbls. in three hours and was shut in for tankage. This well has been in since early in the month but the crew was delayed by casing trouble. It is a Bartlesville sand well at 2,099-2,125 feet, which had been shot with 110 quarts.

New work in the county included: Sinclair Prairie Oil Co.'s No. 2, NE NW NW Section 22-25-6, drilling at 620 feet; J. E. Morrison's No. 1, SE cor. Section 35-25-11, rigged up; Producers & Refiners Corp.'s No. 2, NW SW NW Section 15-24-7, rigged up; Kashike and Peters Petroleum Corp.'s No. 3, SW SE NE Section 16-24-7, drilling at 430 feet; Lewis Production Co.'s No. 2-B, NE cor. SW Section 21-24-7, rig; Champlin Refining Co.'s No. 2, NE NW SE Section 24-24-7, machine; Bay Oil Co.'s No. 1, NW NE Section 13-23-7, drilling at 720 feet; same company's No. 2, NW cor. Section 13, a rig; L. R. Slith's No. 1, NE SE Section 14-23-7, location; E. O. Platter's No. 11, NW SW NE Section 30-22-9, location; Clint Moore Estate's No. 2, C N half NE NW Section 34-21-9, location.

C. T. Matthews' No. 2-A, CNL SE NE NW, Section 26-21-9, was abandoned as dry at 1,115 feet.

Okmulgee and Muskogee Counties

Steckoll & Havell's No. 3-A Likowski had salt sand at 1,616-46 feet, shot it with 60 quarts, and the well made 20 bbls. in 24 hours.

Samples and others lost the hole and abandoned No. 2 Smith, SW NW Section 18-13-13, at 2,113 feet. It had 3 feet of sand which showed 500,000 feet of gas and 10 bbls. of oil.

Harmon Brothers' No. 1-A Jackson, NE cor. Section 9-12-14, McIntosh County, made a 2,000,000-foot gasser at 1,950-60 feet. It was shut in.

Rossiter Oil Co.'s No. 7 Burgess, CNL NE NW Section 20-12-13, was shot with 40 quarts at 2,129-49 feet and made a 20-bbl. initial production.

Haskell Gas Co. was drilling at 1,111 feet in No. 1 Barrett, NE SW NW Section 35-16-15; Pappoose Oil Co. and Steckoll's No. 2 Hawkins, NW SW Section 15-15-13, a rig; Oklahoma Oil Corp.'s No. 1-A Jackson, CEL SW NE Section 35-15-14, machine in to deepen from 1,202 feet; Colton and Phillips Petroleum Co.'s No. 1 Welsh, SE SW Section 29-14-12, spudded; Gled Oil Co.'s No. 18 Fox, NE cor. SW Section 22-13-14, rigged up.

Tulsa and Wagoner Counties

Small gassers and a crop of dry holes were all Tulsa and Wagoner County operators got in the past week. C. R. Fortner's No. 1 Partridge, SW SE Section 32-19-11, west of Sand Springs, made a 250,000-foot gasser in Taneha sand at 1,898-1,912 feet, and was shut in.

J. E. Martin's No. 4 Kelly, CSL SE NW Section 35-18-15, Broken Arrow district, was a 1,000,000-foot gasser at 1,028-31 feet.

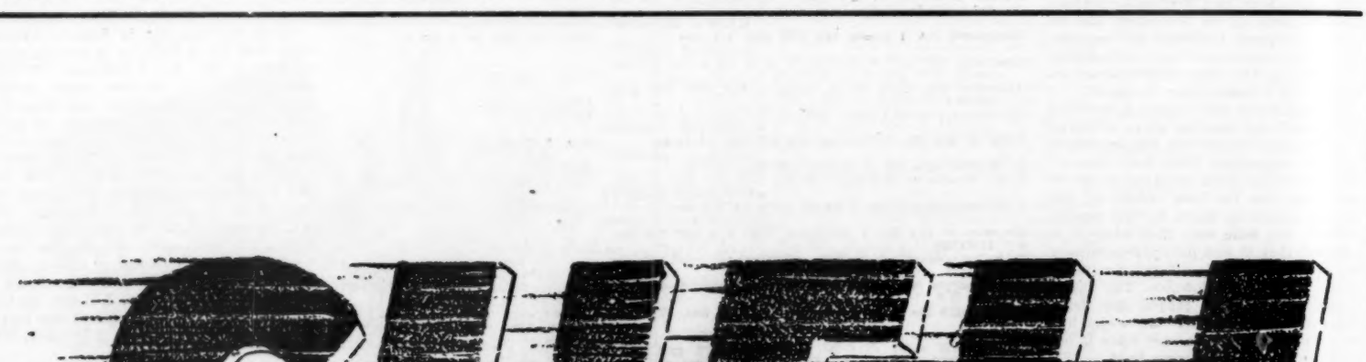
Howard & Duffield's No. 1-A Coonhead, SE NE Section 12-17-12, was dry and abandoned at 1,875 feet.

McFadden's No. 2-A Bunger, NE SE NE Section 28-17-13, was dry and abandoned at 2,014 feet, 2 feet in Wilcox sand.

McIntire and others' No. 4 E. Tiger, NE NW Section 2-17-15, Coweta district, was dry and abandoned at 1,047 feet.

Knox & Shouse had a dry sand at 1,147-60 feet and were shut down on No. 1 J. Berryhill, C NW SW Section 11-17-15 (corrected location).

Bryan Petroleum Corp. drilled a fail-



are in No. 1 Wilcox, CEL SW NW Section 2-16-14, total depth 1,457 feet.

Greer and others had a rig up for No. 1 Grayson, NW NE NE NW Section 18-19-14. Dunbar and others made a location for No. 2 Grayson, SE NW NE SW Section 22-18-15. Sheridan Oil Co. was drilling at 300 feet in No. 5 Snake, CEL SE NW Section 26-18-15. B. G. Goble had machine in for No. 1 Smith, CSL SE SE Section 34-18-15. McIntire and others were drilling at 1,025 feet in No. 5 E. Tiger, C S half NE NW Section 2-17-15.

Pontotoc and Pittsburg Counties

Completions in Pontotoc County were nil in the past week, but several new operations were started. Pierson and others have a rig up for No. 1, C NE NW SE Section 7-5-5, between the Beebe and Allen Pools; Harry Hawkins made a location for No. 1, C N half Section 25-5-8, in the Allen area, and the H. & M. Drilling Co. was drilling at 500 feet in No. 3-A Smith, NW NE Section 20-5-8. Hercules Gas Co. was drilling No. 1-A Reeves, NW SW SE Section 28-4-6, at 327 feet. Superior Oil Co. was rigging up No. 1 Hardin, NW cor. Section 30-2-7.

E. H. Moore and others' No. 1, in Section 25-5-4, which came in late in July producing 225 bbls. a day from Viola lime at 2,351-2,515 feet, was drilled to 2,588 feet and acidized. When opened it started off at 30 bbls. per hour.

In Pittsburg County, Utilities Production Co.'s No. 5 State Bank, C NW NW Section 9-7-18, had a 1,000,000-foot gas production from Hartshorn sand at 1,725-35 feet. Same company had made location for No. 1 V. Carney, C NE NE Section 9-17-18, and was drilling at 1,342 feet in No. 1 Zelinka, C NW NW Section 10-7-18.

Southern Operations

In Jefferson County the Farlyn Oil Co. completed No. 10 O. W. Seay, NW SW SE Section 3-7s-5w, as a 50-bbl. well from sand at 1,192-1,222 feet, and its No. 11, SE NW Section 3, was estimated at 40 bbls. from sand at 1,067-95 feet. No. 12, a twin to No. 11, was drilling at 380 feet. Southern Oil Co. had a rig up for No. 7 W. D. Seay, a twin to No. 6, SE SW NW SE Section 3-7s-5w, and was shut down at 1,163 feet for casing. It has oil sands at 1,092-1,111 feet and 1,-113-28 feet. Southern Oil Co. was drilling at 560 feet in No. 1 Seay, NW SW NW NE Section 3-7s-5w. Harvey & Stone have 3,500,000 feet of gas in sand at 618 feet in No. 1 Pennington, SE NW SE Section 17-7s-5w, and was drilling at 631 feet.

In the Tatums Pool in Carter County, Samedan Oil Co.'s No. 6 Hopson, NW SE NE Section 25-1s-5w, swabbed 1,224 bbls. in 24 hours and was completed. It is producing from a sand series at 2,439-2,655 feet and has started drilling No. 6 Hopson, C NE NW NE Section 25.

New work in the southern counties include Jack Cohen and others' No. 1 Kennedy, C NW SE SW Section 1-2s-3w, Carter County, rig; R. T. Poland and others' No. 1 Green, C NE NW NW Section 8-1s-4w, Carter County, rig on the ground; Carter Oil Co.'s No. 1 Dolman, C NW NE NW Section 10-1s-3w, drilling at 780 feet.

In the Lucien Field

In the Lucien Field in southwestern Noble County, the week was spent in working on wells that had already been reported as producing. None of these was completed and there were no new oil showings. The Stanolind Oil & Gas Co. and Continental Oil Co.'s No. 1 Boley, C SW NW Section 16-20-2w, swabbed and flowed 264 bbls. of oil and 10 bbls. of water in 24 hours, the oil coming from the Oswego lime, to which the hole has been plugged back from 5,262 feet. The Lucien Consolidated's No. 1 Magney, C SW SW Section 17-20-2w, made a flow of 735 bbls. in 24 hours, and same operators' No. 1 J. Boley-A, C NE NE Section 18-20-2w, flowed 965 bbls. on a 24-hour test. Same operators' No. 1 L. Miller, C SE SE Section 18-20-2w, was given a potential test and made 2,293 bbls. in 12 hours and 3,500,000 feet of gas. It was shut in. Stanolind Oil & Gas Co. and Amerada Petroleum Corp.'s No. 1 D. L. Kolb, C NW NE Section 33-20-2w, was shot with 20 quarts in first Wilcox sand at 5,100-10 feet and then shot with 40 quarts at 5,093-5,105 feet and the well flowed 114 bbls. in 24 hours, with 1,000,000 feet of gas. This well had second Wilcox sand at 5,175-80 feet but it showed only water.

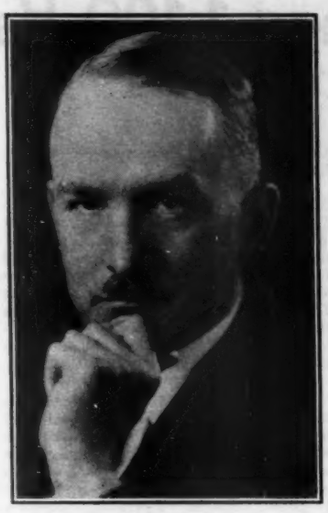
Lucien Consolidated Oil Corp.'s No. 1 Moelling, C SW SE Section 17-20-2w, was drilling at 1,012 feet and its No. 2 Wolfe, C NW NW Section 17-20-2w (on the discovery lease), was at a total depth of 4,504 feet with the crew fishing for 300 feet of drill pipe. Same operator's No. 1 Webber, C NW NW Section 20-20-2w, was drilling in lime at 4,703 feet and looks like the next well to show results.

Payne County

Amerada Petroleum Corp. and Stanolind Oil & Gas Co.'s No. 1 Bryant, NW SE SE Section 6-18-5, about 7 miles northeast of the city of Cushing, Payne County, made two flows of oil, a total of 65 bbls. in 12 hours. It had second Wilcox sand at 3,640 feet, total depth 3,686 feet.

Edwin M. Higgins Dies on Way to A.P.I. Session

CHICAGO, Oct. 23.—Edwin M. Higgins, aged 52, managing director of the California Oil and Gas Association, of Los Angeles, died early this morning on



EDWIN M. HIGGINS

the train en route from California to the annual convention of the American Petroleum Institute here. He had been connected with the Association for 10 years and had been managing director since 1924. He leaves a wife and two daughters.

JOINS BARNSDALL SUBSIDIARY

COUNCIL BLUFFS, Iowa, Oct. 23.—Henry E. Wormhoudt, formerly assistant general sales manager of the Phillips Petroleum Co. in Bartlesville, Okla., has been made vice president of the Mona-Motor Oil Co., marketing subsidiary of the Barnsdall Corp. His headquarters will be in Council Bluffs. Mr. Wormhoudt succeeds Clyde Fuller, who resigned to enter banking.

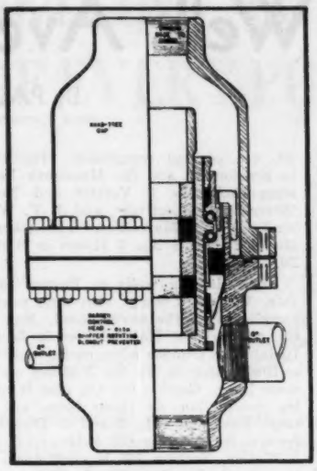
CALIFORNIA GEOLOGISTS

LOS ANGELES, Calif., Oct. 21.—The annual meeting of Pacific Coast section of A.A.P.G. will be held in the Biltmore Hotel, Los Angeles, Calif., November 9 and 10, 1933.

JACK LAFFERTY KILLED

Jack Lafferty, independent operator of Los Angeles, Calif., who went to Nicaragua to drill a wildcat for a Boston oil firm, was killed at Managua in an airplane accident on October 18.

The Shaffer ROTATING BLOW-OUT PREVENTER



When Used With the Warren Head

The Rotating Blow-Out Preventer can also be supplied with a Warren Control Head so that shut-offs or pipe connections can be made even with pipe in the hole. The patented flange feature provides a means of making any type of connections desired with the well under complete control; yet with the advantage of being able to drill always available.

The Shaffer Rotating Blow-Out Preventer consists of a steel bowl in which is a complete packing assembly that is held in place with a bonnet. This assembly provides for packing either around the grief stem or around the drill pipe; and both types may be furnished with each preventer.

The essential part of the assembly is a long sleeve which rotates within the packer and which is carried on two sets of ball bearings to eliminate friction. Inside this are steel bushings and rings of oil-resisting rubber packing that are shaped to fit a particular sized Kelley or pipe. These prevent leakage as they revolve with the Kelley or pipe.

The ball bearing sleeve is carried by a stationary packer in the body of the head and is packed off by a heavy ring. Packing is in turn provided to prevent leakage between the rotating sleeve and the stationary packer. Complete protection is thus provided when the well is drilling.

When combined with the Shaffer Cellar Control Gates and other necessary Shaffer equipment, the Rotating Blow-Out Preventer provides complete well control at all times with the additional advantage of offering no interference to drilling. Danger of frozen pipe is diminished, mud circulation is used to its greatest advantage, and gas pockets or high pressure water zones are handled with ease. The Rotating Blow-Out Preventer offers a means of overcoming adverse conditions as well as preventing trouble.

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Important Extension of Vernon Field, Michigan; Six New Wells Average 1,100 Barrels Each

By PAUL A. ELLIOTT
Staff Correspondent, Michigan Fields

MUSKEGON, Mich., Oct. 23.—Three outstanding developments in Michigan this week resulted in an important extension of the Vernon Township, Isabella County Pool, completion of the largest gas well in the shallow Michigan series just above the Marshall in Austin Township, Mecosta County, and completion of the largest recent well in East Pool in Greendale Township.

Six new oil wells, two in Vernon Township, Isabella County; one in Greendale Township, Midland County, and three in Porter Township, Midland, added an aggregate initial of 7,000 bbls., averaging more than 1,100 bbls. to the well.

Three of the six wells, two in Porter Township and the other in Greendale, made 1,500 bbls. or more initial in the Dundee pay. The most unexpected was the Theodore Oil Co.'s No. 3 Speed, SW NE SE Section 8-14n-2w, Greendale Township, which at first showed only 40 bbls. a day but surprised the operators when it blew in for 1,500 bbls. after being drilled a few feet deeper. It is the largest completion in the East Pool for several months.

Big Producer in Porter Township

One of the most interesting completions was George Hanners and others' No. 1 on the Porter Center Free Methodist Church property which came in making 80 bbls. an hour for an estimated initial of 1,500 bbls. It is located SE SW NW Section 17-13n-1w, Porter Township, Midland County, near Pure-Howard's No. 2, which made 10,000 bbls. initial last week.

Ed Stewart and Gordon Oil Co. brought in their No. 2 Carter, NE NW NE Section 21, Porter, for an initial of slightly more than 1,500 bbls. a day. It made 1,105 bbls. in 17 hours and was estimated good for at least 1,560 bbls.

The most important new well and the greatest extension in the Vernon Township Pool was Templemayr and Tope's No. 1 Reakes, SE SW NW Section 15-16n-4w, pushing out the northern boundary fully a mile. It is the third extension of the old Vernon Field this year which has been receiving almost as much play as the Porter Township Pool. Mammoth Petroleum Co.'s No. 1 Verette in Section 23 was an important east extension while J. C. Arthur's No. 1 Beatty in Section 21 widened the pool to the west.

Mellon Pollock Oil Co. also brought in a smaller producer in Vernon Township, its No. 4 Stough, NW SW SE Section 23, which made 700 bbls. initial in the Dundee pay.

Pure Oil Co.'s No. 4 Hill, NW SW NW Section 17, Porter Township, was the sixth new producer in the Mount Pleasant area. Two other wells were increased in Porter Township by further drilling and acid treatment, respectively. Davis Oil Co.'s No. 2 Nitzke, NW NE SE Section 21, went to 40 bbls. an hour, or about 800 a day, from an original 500-bbl. flow, and Stoddard and Darke's No. 1 Emery in Section 21 jumped from 320 to 740 bbls. after acid treatment. Originally it also was a 500-bbl. well but had declined to 320 bbls.

The only failure of the week was Atha Oil Co. and Columbia Oil & Gas Co.'s No. 1 Van Connant, SW SW SE Section 25, Vernon Township, which last week appeared good for 10 bbls. a day on the pump as a southeastern outpost but this week was abandoned after drilling into water and to a total depth of 3,907 feet.

Four Vernon Township wells, three in Section 23 and the fourth in Section 26, are nearing completion. The three in Section 23 are the Mammoth Petroleum Co.'s No. 3 Verette and No. 3 Marceilles, respectively, and J. V. Wicklund's No. 1 Marceilles. The other is Mellon-Pollock's No. 2 House in Section 26.

Eight drilling wells in Porter Township, Midland County, also were nearing completion as the week closed. Sun Oil Co. was drilling No. 2 Miller in Section 16 into the Dundee after casing and was setting casing on its No. 3 Miller on the same lease. Gordon Oil Co. also is nearing completion on three holes on the same lease, Nos. 1, 2 and 3 Diebel in Section 18. Strange Oil & Gas Co.'s No. 3 Walley, Section 16, is shut down on top of the Dundee. W. J. Wilson and B. J. McGee's No. 1 Hodge, in Section 18, is casing and drilling in. Charles Smith's No. 2 Buschre in Section 22 is about ready to case. Three others in Porter Township are drilling in the Traverse, including George Hanner's No. 2 Hathaway in Section 17, and the Stork Oil Co.'s No. 2 Baxter and No. 3 Hill, both in Section 22.

J. Mark Harvey's No. 1 Messenger, NE NE Section 36, a semiwildcat in Porter Township, Midland County, is shut down on top of the Dundee. Michigan Producers & Refiners' No. 1 Bond Heirs in Section 14, Greendale Township, another semiwildcat, is nearing the Dundee. Ten other wildcats are active in various sections of the county, including Mount Haley, Porter and Lee Townships.

Mecosta County

H. C. Nelson of Muskegon brought in the largest dry gasser so far encountered in the shallow Michigan series just above the Marshall in any of the four areas where this gas pay sand has been discovered. His No. 1 Spittler in Section 11-14-9w, Austin Township, Mecosta County, made 14,000,000 feet a day initial after hitting the pay sands at 1,461 to 1,465 feet. It was shut in pending the laying of a line to Big Rapids, 10 miles north.

The Spittler well more than doubled the potential daily capacity of the Austin Township Pool as two previous gassers completed by James M. Taggart and others have an aggregate open flow of but 10,000,000 feet. Mr. Taggart this week started a third well on the Robert S. Fish lease, C SE SE Section 4-14n-9w, Austin Township.

Semiwildcat and wildcat testing in Ogemaw County more than 50 miles north of the Mount Pleasant area continued. Five tests are now being drilled with others to be started.

R. D. Malcolm's No. 1 Cook in Section 2, Broomfield Township, Isabella County, is expected to be drilled into the Michigan gas sand soon as an outpost. J. E. Harding is starting another Broomfield test on the Todd lease in Section 7 on the west side of the proved area.

Two other wildcat tests are drilling in Montcalm and one in Gratiot County. The Montcalm wells are Daily Oil Corp.'s No. 1 Christensen, Section 10, Home

(Continued on Page 114)

Central Ohio Showing More Drilling Activity; Two Completions Reported in Kentucky

By GEORGE A. WHITNEY
Staff Correspondent, Central West Fields

FINDLAY, Ohio, Oct. 23.—The most active area of the Lima Field is centered in Crane Township, Wyandot County, where Jones & Coyle's No. 6 on the Margaret Brillhardt, Section 28, produced an initial of 100 bbls. from the Trenton lime at from 1,298-1,328 feet. In the same township, W. J. Dempsey and others of Lakewood, Ohio, drilled a test on the S. B. Hooper farm, Section 6, Crane Township, which was dry at 1,322-82 feet. Keiner and others are down 1,350 feet in No. 5 on the Louisa Brandt farm, Section 34. Upper Sandusky Oil & Gas Co.'s No. 6 on the O. J. Weiker farm, Section 29, showed 1,000 feet of oil in the hole from 1,299-1,317 feet and will be given a shot later on. Pitt Oil & Gas Co. is shut down at 1,347 feet in No. 1 on the A. E. Myers farm, in Section 3. Upper Sandusky is drilling below 300 feet in No. 2 on the Mary Loverick farm, Section 29. McPherson and others are drilling No. 1 on the Francis Huffman farm, Section 27. Maesa Oil & Gas Co. is drilling No. 2 on the Mary Sampson farm, Section 20. Robert Kirk and others are drilling No. 1 on the Joseph Courtad farm, Section 27. Cobb & Ringle are drilling No. 2 on the Earnest Kuenzli farm, Section 35.

In Pitt Township, Newcomer and others are drilling No. 1 on the W. G. Castanein farm, Section 11, same county.

In the Tiffin Field, Keiner and others' No. 2 on the Charles Dumit farm, Section 24, Liberty Township, Seneca County, was dry in the Trenton lime from 1,376-1,466 feet.

R. W. Kirk and others' No. 1 on the Elmer E. Moser farm, Section 12, Ridge Township, Wyandot County, failed to find a commercial well at a total depth of 1,983 feet.

Simms Oil & Gas Co. is drilling below 350 feet on the Douglas Poe farm, Section 4, Roundhead Township, Hardin County.

CENTRAL OHIO

The Central Ohio Field shows more drilling activity than any other division of the Central West Field. Stark County alone has 32 wells drilling and 4 rigs. In this county oil and gas are found at around 4,000-4,600 feet. For the week three completions were reported: Brendel Producing Co.'s No. 1 on the Lillian Shoemaker farm, Section 5, Plain Township, the gas being found from 4,495-4,519 feet; No. 1 on the Valentine L. Ney farm, Section 10, same township, found its gas in the Clinton lime formation at 4,553 feet; and Cunningham Natural Gas Co.'s No. 2 on the John Marquardt farm, Section 8, same township, was a good gas producer at from 4,478-4,504 feet in the same formation. Brendel Producing Co. has a number of wells near the gas formation. Among them are: No. 1 on the Elm Wood Park Land, Section 14, same township, below 4,400 feet; No. 1 on the L and E. Fritz farm, Section 10, 4,200 feet; No. 1 on the Peter C. Graber farm, Section 12, 4,200 feet; No. 2 on the J. S. Unger farm, Section 17, 3,900 feet; No. 1 on the H. L. Shriver farm, Section 10, in Jackson Township, same county, 3,000 feet; No. 2 on the Henry Huthmacher farm, Section 11, Jackson Township, 2,300 feet; and No. 1 on the Cora L. Clay farm, Section 11, same township, 2,700 feet. Same company is spudding in No. 2 on the James H. McDowell farm, Section 16, Plain Township, same county, and is drilling below 3,100 feet on the W. J. Lynn farm, in Lot 50, Deerfield Township, Portage County.

Cunningham Natural Gas Co. is drilling No. 3 on the John Marquardt farm, Section 9, Plain Township, Stark County. Fulton Oil & Gas Co. is drilling around 2,700 feet on the Jacob Schworn farm, Section 27, Jackson Township, same county.

In Ashland County Meltzer and others' No. 7 on the Clark Alber and others farm, Lot 34, Mohican Township, produced 25 bbls. initial at from 747-99 feet. Moore and others are drilling No. 7 on the George W. Black farm, Lot 34, same township.

In Lorain County, Ohio Fuel Gas Co. is drilling No. 1 on the John Rising farm, Lot 95, Grafton Township; Edson Co. is drilling on the John Burhardt farm, Section 4, Avon Township, and R. E. Cain is drilling on the Clarence Brooks farm, Lot 100, Russia Township, same county.

In Medina County, D. A. Lake drilled a dry hole in No. 7 on the L. A. Severcool farm, Lot 1, Litchfield Township, at 260-321 feet. Same party's No. 8 on the same farm, same section, was good for 36 bbls. at 315-53 feet; while No. 9, same farm, produced an initial of 20 bbls. from 264-97 feet, same lot.

In Wayne County, Ohio Fuel Gas Co. is drilling No. 1 on the Jennie DeMay farm, Section 13, Congress Township. Preston Oil Co. is drilling No. 3 on the Phillip Collier farm, Section 19, Hardy Township, Holmes County.

In Summitt County, East Ohio Gas Co. drilled in a gas well at 3,995-4,032 feet in No. 1 on the J. E. Wertz farm, Section 27, Greene Township. Same company is drilling No. 1 on the F. N. Steiner farm, Section 18, same township and county.

In Fairfield County, City Natural Gas Works has a rig in for No. 2 on the Mary Everett farm, Section 16, Berne

Township, and is drilling No. 5 on the Cyrus B. Ricketts farm, Section 12, same township.

In Knox County, Preston Oil Co.'s No. 3 on the A. J. Beatty farm, Section 21, Butler Township, produced 31 bbls. initial from 3,168-3,218 feet.

In Licking County, Blue Rock Oil & Gas Co.'s No. 5 on the W. D. Booth farm, Section 14, Fallsburg Township, produced an initial of 75 bbls. from 2,974-3,033 feet. Emereld Petroleum Co. has a rig in for No. 2 on the Calvin Mossholder farm, same section.

In Muskingum County, Pure Oil Co. has a rig on the Emmett Shephard farm, Section 6, Jackson Township.

In Athens County, C. M. Nuzum's No. 5 on the A. L. Cole farm, Section 24, Rome Township, was dry at 1,006 feet. Stewart & Ross are drilling on the Joseph Weiland farm, in Fractional Section 7, Cannon Township, same county. Williams Brothers are drilling No. 1 on the Charles Caldwell farm, Section 17, Berne Township, same county, and Ohio Fuel Gas Co. is drilling No. 13 on the Black Diamond Coal Co.'s property, same section, and has a location for No. 1 on the Albert M. Funk farm, Fractional Section 4, same township.

In Belmont County, Robert Morgan and others' No. 7 on the William Shephard farm, Section 21, Union Township, is reported dry. R. W. Dunn and others are drilling No. 1 on the Louis Gilham farm, Section 15, same township, and Ohio Fuel Gas Co. is drilling No. 1 on the J. Frank Pollock farm, Section 31, same township, and has made a location for No. 1 on the M. L. Bell farm, same section. In Somerset Township, A. C. Peters and others are drilling No. 5 on the Rosalia Johnson farm, Section 27. Robert Lewis is drilling No. 2 on the C. F. Finch farm, Section 28, Warren Township, same county.

INDIANA

Only one completion was reported from the Indiana fields during the week, Blosser & Coleman's No. 1 on the H. G. Campbell farm, NE Section 17, Center Township, Vanderburg County, which was reported dry. Knapp & Woods are drilling No. 4 on the Southern Indiana Gas & Electric Co.'s right of way in Section 36, same township. John L. Drake is drilling No. 6 on the J. M. Effinger No. 1 farm, in the NW of Section 33, same township.

KENTUCKY

Two completions were reported from the Kentucky fields, the best well being George Stewart and others' No. 3 on the E. C. Dunn farm, in the Newton Pool, in Ohio County, which produced 40 bbls. initial from the Jett sand.

S. R. Nigh and others' No. 21 on the A. P. Kelley 340 acres, in the Kelley Pool, Ohio County, produced an initial of 14 bbls. from the Barlow sand.

No completions were reported from the Illinois fields.

Most Northerly Well in Lost Run Pool, 50-Bbls. Initial; Expected to Improve

By STAFF CORRESPONDENT

PITTSBURGH, Pa., Oct. 23.—In Lost Run Pool, Clay district, Ritchie County, West Virginia, C. F. Vincent and Frank Finley and others completed a test on the John T. and Ella B. Fox farm, mapped as the Biddie Fox farm. It is a 50-bbl. well in the Injun sand, initial, and is expected to improve as the depth increases. This is the most northerly of all the wells drilled along the Injun sand streak and offsets the Charles H. Frederick farm.

Since the discovery, this pool has shown remarkable staying power. The original well, which was completed on the Edgar Hinton farm in late February, is still producing in excess of 50 bbls. a day. The Richards Farm Oil Co. shot its No. 3 on the Frank R. Ball farm and increased production from 60 to 175 bbls. a day. On the Boehm and Strickler farm, one well of the four completed is making about 300 bbls. a day. The second test on the Corlie Ball farm, mapped as the Mike Moran farm, is producing about 100 bbls. a day. The Satterfield test is producing about 90 bbls. a day, and the Charles H. Frederick test is down to about the same amount. The test of Lucas and Mahaney on the Catherine Ball farm is good for about 75 bbls. a day.

Drilling in this pool at the present time, Richardson and others are about on top of the Injun sand on the Ruth Andrews farm. The Richards Farm Oil Co. is drilling at 1,000 feet in No. 4 on the Frank R. Ball farm and has a rig standing for No. 5. Ralph Roberts has reached 600 feet on the Sada McGinnis farm. Smith and Hendershot are drilling at about 550 feet in a second test on the Charles H. Frederick farm. Boehm and Strickler Oil Co. is rigging up for No. 5 on the Boehm and Strickler farm.

Some fair oil and gas wells were completed in the lower eastern fields during the week. Fifteen wells were completed, eight of them being producers with an initial production of 183 bbls. There were two dry holes.

SOUTHWEST PENNSYLVANIA

One well was completed in Southwest Pennsylvania during the week. In Beaver County, Frank Crooks and others completed No. 1 on the Mrs. Sarah Dawson farm in Ohio Township in the 100-foot sand and it is showing for about 1 bbl. a day natural. The well will be shot.

In Greene County, Peoples Natural Gas Co. drilled its No. 3,538 on the J. W. Mitchell farm in Alleppo Township deeper to 3,655 feet. It was dry and is being abandoned. The Pittsburgh Coal was at 1,015 feet. In Gilmore Township, the same company drilled deeper its No. 3,535 on the Matthew Hennan farm to the Speechley sand. It was also dry and is being abandoned. The coal was at 1,029 feet. In Dunkard Township, Convex Glass Co. drilled its test on the Samuel Morse farm to the Speechley sand, a depth of 3,380 feet. It is a dry hole and is being plugged.

In Washington County, Hallam and Lewis and others are drilling at 2,970 feet on the H. D. Ely farm in East Findley Township. Some gas was struck in the 50-foot sand which extended from 2,770 to 2,785 feet. The gas streak was at 2,783 feet and is estimated at about 104,000 feet a day. Drilling is being continued with the hole filling up with water from the Gordon sand. In Amwell Township, Manufacturers Light & Heat Co. is down 2,400 feet on the Maggie I. Craft farm and drilling in the Murraysville sand. In South Franklin Township, E. H. and J. B. Tague have started drilling No. 7 on the Adaline D. McKennan estate.

In Hanover Township, Washington County, Carnegie Natural Gas Co. is drilling deeper its well on the J. C. Baim farm and has reached the Big Lime at 1,667 feet. It will probably be drilled to the Fifth or Bayard sands. In Cecil Township, Allegheny County, Steele & Co. are spudding on the R. C. Brown farm. In Hanover Township, Beaver County, Duncan and Coulter are drilling at 300 feet on the J. D. Cooley farm.

In Fayette County, Carnegie Natural Gas Co. is drilling on the C. B. Wilkey farm in Jefferson Township. It is down 460 feet and drilling about on top of the Pittsburgh Coal.

WEST VIRGINIA

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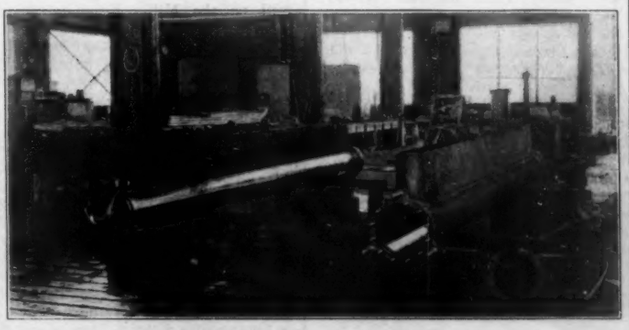

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TWIN DISC CLUTCHES

trict, Gilmer County, Hope Construction & Refining Co. drilled its No. 1,149, or the second test on the Mary A. Stump farm, deeper from the Maxon sand to the Berea sand, a depth of 2,377 feet. The well produced 100 bbls. the first 17 hours. There are few Berea sand wells in this vicinity, practically all being shallower completions. It will probably stimulate deeper drilling.

In Calhoun County, L. P. Bickel completed No. 12 on the Martha Stump heirs farm in Sherman district in the Salt sand at 1,500 feet. It is showing for a 10-bbl. producer.

In Ritchie County, on the waters of Sheep Run in Grant district, H. N. Rinehart completed No. 4 on the F. H. Markey farm in the Horse Neck sand. It is showing for a 1-bbl. pumper.

Gas Wells

Several of the gas wells completed proved fair wells. In Boone County, Pure Oil Co. completed its No. 61 on the Federal Coal Co. tract in Sherman district. It was drilled to a depth of 2,360½ feet and is showing for about 250,000 feet a day from the Big Lime and the Berea sands.

In Calhoun County, two gas wells were completed. In Center district, W. A. Bickerstaff and others completed a second test on the Edward Gainer farm in the Injun sand at 2,059 feet. It is showing for about 400,000 feet a day. In Sheridan district, L. B. Carroll completed No. 13 on his own property in the Injun sand and it is a gas well gauging at about 100,000 feet a day.

In Gilmer County, on the waters of lower Tanner Creek in DeKalb district, Clem S. Morris and others drilled a test on the J. S. Gainer heirs farm. It is an Injun sand well and gauges for about 750,000 feet a day.

In Kanawha County, Pure Oil Co. completed a test on the Cheylan Coal Co. tract in Cabin Creek district in the Berea sand at a depth of 2,851 feet. It gauged in excess of 1,000,000 feet a day.

In Wirt County, Glen W. Roberts and others completed a fair gas well in their No. 3 on the George W. Hall heirs farm on Rock Run in Burning Springs district. It was completed in the Keener sand and is estimated good for 1,000,000 feet a day. In Wetzel County, Ray Hennen drilled No. 4 on the Jesse Parson farm in Proctor district to a total depth of 2,970 feet. It proved a dry hole.

Drilling in West Virginia

A number of new drilling permits were granted by the oil and gas division of the West Virginia Department of Mines during the week. In Cabell County, permits were granted to the Empire State Gas Co. on the M. Hale and others lease in McComas district. In the same district West Virginia Gas Corp. has one for a well on the Millie Ferguson farm. In Gideon district, Huntington Land Co. farm has three locations for wells by J. H. Wilson, permits granted. In Boone County, Columbian Carbon Co. has a permit for a well on the Brown and Cochran lease, Sherman district. In Doddridge County, Philadelphia Oil Co. has a permit for a well on the John C. Coulehan estate in West Union district. In Ritchie County, J. J. Graham has a permit for a test on the P. M. McGinnis farm in Grant district. In Wetzel County, Browns Run Gas Co. has a permit for a well on the Paul Oates farm.

In Cabell County, R. H. Adkins and others have started drilling a second test on the E. H. Darnell and others lease in Guyandotte district. Martin and Swanson are drilling at 1,575 feet on the Humphrey farm; H. H. Baker Gas Co. is down 975 feet on the J. M. Lewis farm; all in Guyandotte district. In McComas district, West Virginia Gas Corp. has resumed drilling in its test on the H. L. Day farm and reached 2,335 feet.

In Calhoun County, new work is progressing. In Lee district, South Eastern Gas Co. has a rig standing for No. 3 on the John Slider farm. F. F. McIntosh is down 1,640 feet in No. 4 on the S. A. Hays farm. In Washington district, C. B. Lewis is spudding on the Mary Fleming farm. In Sherman district, F. F. McIntosh is building a rig for a second test on the O. S. Bennett farm. Creed Barker and others are on top of the Injun sand and drilling at 2,010 feet on the M. C. Haught farm. Carnegie Natural Gas Co. is down 350 feet in No. 1,483 on the R. F. Bennett farm. In Center district, M. V. Burt and others have a rig standing on the Beeman Wright farm and Fisher and Smith have the material on the ground on the C. A. and M. S. Snider farm. In Sheridan district, M. F. Crawley is drilling deeper his No. 1 on the L. E. Hughes farm and has reached 1,775 feet.

In Gilmer County, McCall and others are down 1,000 feet in a second test on the Lee Gainer farm, DeKalb district. In this district, Harlet Satterfield and others have reached 575 feet on the Rosa Ellyson farm on Sinking Creek and Charles Despard has rigged up for his test on the M. L. Amos and others lease.

In Monongalia County, Chartiers Oil Co. is drilling at 3,230 feet on the Thomas Williams heirs farm in Clay district. In Battelle district, Manufacturers Light & Heat Co. is down 3,440 feet in drilling deeper its test on the Henry Yost farm.

In Ritchie County, A. H. Jackson has completed a rig on the J. W. Heffner farm in Murphy district. In this district, W. A. Bickerstaff is rigging up on the Hiram Williams farm. F. S. Deem and others have started drilling on the Mary and John Border farm; Wilson and Baker are drilling at 1,200 feet in No. 24 on the Ritchie Mines, and Southern Oil Co. is drilling at 1,860 feet in No. 4 on the Alvin Wince farm being drilled deeper; all in Murphy district.

In Wirt County, R. C. Wagner has a rig standing on the M. Richter heirs farm in Burning Springs district. In Meade district, Tyler County, Ohio Oil & Gas Co. is down 1,400 feet on the C. W. Smith farm.

SOUTHEAST OHIO

Three producers, one gas well and one dry hole was the total of the new work in Southeast Ohio during the week. All of the production was in the shallow sands of Medina County. In Litchfield Township, D. A. Lake completed No. 8 on the Pearl and Frank Weaver farm in Section 1 in the Berea grit at 328 feet. It produced 15 bbls. the first day after shot. In Chatham Township, Tract 15, Lot 12, E. R. Edson & Son Co. completed No. 36 on the Ed G. Miller farm. It produced 3 bbls. the first day after shot from the Berea grit at 470 feet. In the same township but Tract 10, Lot 3, Oko Oil & Gas Co. completed No. 38 on the Sanford and Watson lease at 328 feet in the Berea grit. It produced 3 bbls. the first day after shot.

In Noble County, Roman L. Smithberger completed a test on the John H. Noll farm, NW Section 14, Elk Township. It is a small gas well in the Germantown sand at 1,096 feet.

In Jefferson County, C. S. Kelley and others drilled No. 4 on the Ella E. Baxter farm in Saline Township. It went to a depth of 1,415 feet and found the Berea grit dry.

In Ashland County, Moore and others are drilling No. 7 on the George W Beck farm, Lot 34, Mohican Township. In Tuscarawas County, Hopewell Fuel Gas Co. is drilling on the C. M. Hussey farm, Lot 22, Washington Township. In Muskingum County, Atha Oil Co. is drilling on the G. C. Wilson farm in Washington Township.

In Licking County Emerald Petroleum Co. has a rig standing for a second test on the Calvin Mossholder farm, Section 14, Fallsbury Township. In Franklin Township, Wehrle Co. is drilling a second test on the O. E. Kraeger farm in Section 10.

DEATH OF LOUIS T. CALL

FRANKLIN, Pa., Oct. 21.—Louis T. Call, well-known local oil producer, died Thursday afternoon at his home. He had been ill for some time. He had been engaged in the oil business as a producer for the past 35 years. Mr. Call was 72 years old.

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Humble Starting Well in Jal Pool, New Mexico; New Record for Depth Made in Colorado

By TOLBERT R. INGRAM
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., Oct. 23.—The Humble Oil & Refining Co. is starting a well in the Jal Pool in New Mexico, the first it has drilled for some time. Grayburg Oil Co.'s No. 4 Burch, in the Maljamar area, is estimated at 300 bbls. per day after two short tests. One small well was completed in the Artesia area and a wildcat in southern Eddy County began spudding.

Ramsey Petroleum Corp.'s No. 1 Scriven, in northeastern Colorado, has run pipe and will complete in the Muddy sand. Cores showed oil and gas saturation. Mountain Fuel Supply Co. established a new record for depth in Colorado when its deep test on Hiawatha Dome reached 7,577 feet and began plugging back. There were no completions or new locations in Colorado.

Wyoming had another good producer in the west end of the Osage Pool in Hugh Updike & Sons' No. 1, which is flowing 150 bbls. per day. Ohio Oil Co.'s No. 2 Hazlett, on the Allen Dome in Carbon County, gauged 8,600,000 feet of gas in the lower Sundance.

Montana has favorable prospects for another pool in the East Shelby district in Toole County, where C. Leonard Smith's No. 1 is estimated at 25 bbls. per day. Four new locations were released in Cut Bank. One location was made on the Elk Basin Dome.

NEW MEXICO

Lea County

Shell Petroleum Corp.'s No. 3 Grimes, SW NE SW Section 28-18-38, the only well drilling in the Hobbs Pool, is bottomed at 2,750 feet in anhydrite and shale and is running the 9⅝-inch.

Humble Oil & Refining Co.'s No. 3-A Lindley, C NW SW Section 13-25-36, Jal Pool, is building rig. It is a south offset to Continental Oil Co.'s No. 1-B Sholes-13 which made 2,280 bbls. of oil and 40,000,000 feet of gas initial at 3,370 feet, total depth, and an east offset to Empire Gas & Fuel Co.'s No. 1 Lindley, which made 2,000 bbls. of cut oil.

Western-Anton's No. 1 Conditt, C SW SW Section 12-25-36, is trying to test through drill stem at 3,349 feet, total depth. Continental Oil Co.'s No. 2 McCallister A-24, NW NE NE Section 24-26-36, is running 6⅝-inch at 3,067 feet, total depth. It is bottomed in lime and will be an early completion.

Eddy County

Grayburg Oil Co.'s No. 4 Burch, C SE NW Section 19-17-30, Maljamar area, is shut down for rig at 3,125 feet, in lime, following fire. Several short tests have been made. It flowed 30 bbls. in 1 hour and 10 minutes. Later it was tested for 12 hours and made 195 bbls. After being shut in for 24 hours, it made 180 bbls. in a second 12-hour test. It is estimated at 300 bbls. per day. Harry Leonard's No. 9 State, SE cor. NW Section 22-17-29, Jackson area, is drilling at 1,695 feet in anhydrite, and Western Drilling Co.'s No. 2-A Green, C SW NE Section 29-17-29, shut down at 2,440 feet so the crew could assist at the Grayburg well.

Flynn, Welch & Yates' No. 66 State, NW SE SE Section 30-18-28, Artesia area, was completed at 2,000 feet and made 2 bbls. per day on the pump from sand at 1,905-17 feet. Deepening did not improve it. C. H. Lockhart and others' No. 2 Root, C SW SW Section 7-17-30, Maljamar area, is drilling at 3,012 feet in gray lime and had a show of oil at 2,973 feet and another at 2,993 feet.

Stovall & Marshall's No. 1 Mock, C SE SE Section 29-24-27, Black River anticline, in southern Eddy County, for which location was made two months ago, is spudding with machine. A well drilled on this structure to 3,096 feet had a show of oil and gas.

Ralph Spearow and others' No. 1 McClellan, SW NW NE Section 22-22-23, Indian Creek district, 25 miles west of Carlsbad, is shut down at 4,005 feet, in lime. The hole was reduced to 6-inch at 3,996 feet. Pecos Valley Drilling Co.'s No. 1 McIntyre, NW NW Section 27-23-25, Dark Canon, is drilling at 740 feet.

R. D. Compton Oil Co.'s No. 6 State, SW NE SW Section 15-16-23, Upper Cottonwood district, is drilling at 475 feet in brown lime.

COLORADO

Weld County

Ramsey Petroleum Corp.'s No. 1 Scrivens, C NW Section 22-7n-59, Buckingham district, which last week was reported to have cored the Muddy from 6,794 to 6,804 feet, took another core to 6,814 feet, total depth and bottom of the sand. The formation softened considerably in the last core and showed oil and gas saturation. The core had sufficient oil saturation in spots to bleed. It was then decided to run the pipe and test. The 7-inch stuck on the way down, but finally was loosened when oil was circulated and landed at 6,794 feet, on top of the Muddy. Cement then was run, but there is some doubt whether it

(Continued on Next Page)

Light Crude Well in South Turner Valley Area Is Running Between 120 and 150 Bbls. Daily

By VICTOR LAURISTON
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, Oct. 21.—On the west flank of the South Turner Valley structure, Miracle Oils' No. 2, LSD 16, Section 5-19-2w5, has been finished 860 feet in the lime at 6,800 feet depth, and is on steady production. The well reached 152 bbls. in one day, and runs between 120 and 150 bbls. Considerable water came with the oil at first, but this is decreasing, being down to about 30 bbls. a day. Unlike most of the Turner Valley producers from the lime, production of Miracle's No. 2 is graded as light crude oil. The well, after standing for a couple of years at 5,581 feet, was completed this year by Mercury Oils, Ltd. of Calgary which has a half interest in the production.

The light crude strike in this test may result in a lot of new drilling designed to test the possibility of a southwesterly extension. Miracle's No. 2 is close to the westerly fringe of the Benton outcrop, and almost due west of Mercury Oils' No. 1 in LSD 13, Section 4-19-2w5, which was one of the largest naphtha producers in South Turner Valley. Almost due south of Miracle's No. 2, Associated Royalties' No. 1 Spray is drilling in LSD 9, Section 5-19-2w5. These are the most westerly tests on this portion of the structure, and almost at the point where the upper Benton dips below the Belly River formation.

Farther south, in Section 28-18-2w5, drilling has extended south and west of the Benton outcrop, Pacalta Oils' No. 1 and Publix' No. 1 both being started in the Belly River to the south. The most interesting test of the possibilities of a southwesterly extension is, however, Sunburst-Mid-Royal's No. 1 in LSD 14, Section 28-18-2w5. This is west of the Benton outcrop, a considerable distance west of Merland's No. 1 producer, and the most westerly test actually drilling in Section 28. Sunburst-Mid-Royal's No. 1 set the 16-inch casing at 1,401 feet, got the cardium sandstone marker between that depth and 1,550 feet and is reported drilling below 1,630 feet. The cardium marker has logged a little higher here than in Becker Syndicate's No. 2 Anaconda, farther east, which was higher than in Merland's No 1, indicating the formation rises to the west. A show of oil and a small gas production were encountered near the top of the cardium.

The southward extension of Turner Valley drilling has hitherto pretty closely followed the east flank of the structure, where tests carried to the porous horizon of the deep lime yielded wet gas and crude naphtha. There is a considerable area on the west flank practically untested and it is expected operators, seeking light crude rather than naphtha, may give these untested areas attention. Possible drilling activity to the west will depend to some extent on results secured in Associated Royalties' No. 1 Spray. This test, in LSD 9, Section 5-19-2w5, is almost due south of Miracle's No. 2 producer, and after a long delay due to casing troubles is reported running three tours and making rapid headway below 3,410 feet. Casing is being carried down close behind the tools.

North Turner Valley

In the North Turner Valley area, Model Oils' No. 2 Anaconda, LSD 16, Section 22-20-3w5, has been placed on steady production following shooting and acid treatment of the porous horizon in the upper lime. The well is reported averaging about 25 bbls. a day of 72 gravity crude.

South Turner Valley

In the South Turner Valley, Livingston Syndicate's No. 1, LSD 5, Section 34-18-2w5, is standing cemented around 2,865 feet. Sterling Royalties' No. 1 rotary test, LSD 1, Section 33-18-2w5, is drilling below 4,400 feet and averaging around 20 feet a day.

Mar Jon Section

In Section 28-18-2w5, Becker Syndicate's No. 2 Anaconda, LSD 15, is reported drilling below 4,700 feet in the hard iron pyrites band of the Dalhousie formation, after getting a show of gas in the upper Dalhousie at 4,620 feet. Mar Jon Oil Co.'s No. 2 Kindersley, LSD 10, is drilling below 3,528 feet. Pacalta Oils' No. 1, LSD 7, is below 2,850 feet, carrying down close behind the tools. Publix Oil & Gas Co.'s No. 1, LSD 8, is redrilling and has straightened hole to below 995 feet.

Far South Test

In the far south, Union Drilling Co.'s No. 1, LSD 8, Section 21-18-2w5, is drilling below 1,100 feet and apparently in the Benton formation, which in this part of the field is overlain by the Belly River. Most of the tests farther north have started in the Benton. Highwood Sarcee Oils' No. 1, NE, same section, is making new hole below 700 feet after cementing 18⅝-inch casing at 546 feet. Hoffar-Lundy Syndicate's No. 1, LSD 13, Section 22-18-2w5, has finished underreaming and is making new hole below 3,700 feet and carrying down casing behind the tools.

Anaconda Officers

A. C. Johnson of Calgary has been appointed president of the Anaconda Oil Co. Other officers appointed are H. J. Robie and R. J. Gathergood, vice presidents, and A. J. Scott, manager and secretary-treasurer, all of Calgary.

Red Coulee Field

In the Alberta end of the Red Coulee Field, Skov Oil Co.'s No. 1-A Kotop, LSD 2, Section 2-1-17w4, drilled into the Vanalta sand at 2,651 feet and got a heavy flow of sulphur water with no showing of oil. A small oil flow, bailing 8 bbls. in 15 hours, was struck in the Sunburst sand between 2,586 and 2,589 feet. The well, which was on the west flank of the structure, is being abandoned. It was the only active test in the Alberta end.

On the Montana side, Alberta-Development Co.'s No. 1 Buckley rotary test, NE SE SW, Section 1-37n-4w, is reported drilling in the Kootenai formation below 2,250 feet. Askalta Oils' No. 8 Farbo, S half N half, Section 22-37-4w, has spudded.

Border Fields

On the Twin River structure south of Lethbridge, Nordon-Roney's No. 2 Twin River, LSD 11, Section 2-2-20w4, is preparing to test production from the top

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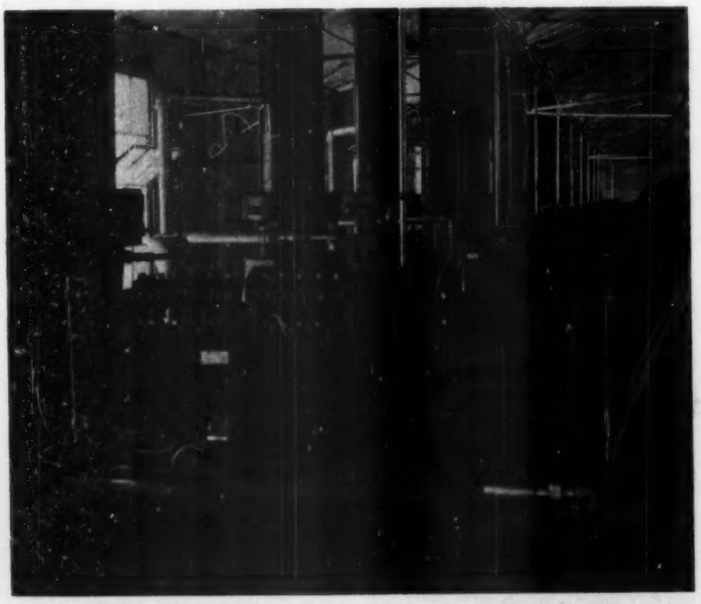

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of the Madison at 3,940 feet.

On the Alberta end of the Reserve Dome structure, Rialto Oils' No. 1, LSD 4, Section 15-1-9w4, is drilling below 1,400 feet after setting 13⅜-inch casing at 1,280 feet.

Hunter Valley Test

In the Forest Reserve area west of Olds, Hunter Valley Oil Co.'s No. 1 McLaren, Township 31-10w5, is at 2,430 feet and drilling out cement which was run to overcome caving.

Resume at Aldersyde

On the High River-Aldersyde test, east of Turner Valley, Ranchmen's Oil & Gas Co.'s No. 1, LSD 16, Section 13-20-29w4, is hauling fuel and will resume drilling shortly at 6,080 feet. This test, some distance due east of the north-central Turner Valley area, has been drilling for a number of years, and has encountered several small shows of oil and gas at various depths. At 5,300 feet it was reported still in the Benton, which is the outcropping formation in the proven section of the Turner Valley Field.

Saskatchewan Gas Test

In southern Saskatchewan, Highwood-Sarcee Oils' No. 2, LSD 8, Section 23-12-24w2, on the Dirt Hills structure, is reported making new hole below 1,700 feet after a brief fishing job at 1,625 feet.

Wainwright Field

An important new development in the Wainwright Field, east central Alberta, is foreshadowed in the incorporation of Gold Standard Oils, Ltd., under Alberta charter. The new company has been organized by the Wright-Hargraves mining interests which recently secured extensive blocks of acreage in the Wainwright Field. In addition to undeveloped acreage, the Wright-Hargraves interests have taken over the leases and producing well of Beaumont Oils, Ltd., these holdings amounting to around 10,000 acres. Beaumont's No. 1 in LSD 1, Section 10-45-7w4, was a small producer at 2,183 feet, and Beaumont's No. 2 in LSD 10, Section 30-45-7w4, got production at 2,210

(Continued on Page 130)

Rocky Mountain Area

(Continued from Preceding Page)

reached bottom. The hole will stand for five days and then the cement will be tested. It is planned to drill out the cement with the 4-inch drill stem and not with cable tools. Also, it is planned to complete the well at this depth and not go to the Dakota. The opinion is generally held that the chances for an oil well are very favorable. The location is three-quarters of a mile southwest of the Ramsey company's No. 1 St. Anthony, a gas well.

Moffat County

Mountain Fuel Supply Co.'s No. 2 Florence Wilson, C NE NE Section 22-12n-100, Hiawatha Dome, was drilled to 7,577 feet and found the basal Mesa Verde sand barren. It was in this sand at 7,517 feet. It will plug back and test a gas sand at 4,770 feet. This sand is above a 50-foot sand tested at 5,063 feet after setting the 8⅝-inch at 4,964 feet. It also had heavy gas in the Wasatch at around 2,210 feet, where the 13⅜-inch was cemented. This test holds the record for depth in Colorado, having exceeded by 267 feet the Rollestone well near Longmont, which was drilled to 7,310 feet in 1928.

Mountain Fuel Supply Co.'s No. 1 Wheeler, SE NW NW Section 30-12-100, is drilling at 1,805 feet, and the Texas Co.'s No. 1 Van Schaick, SW cor. Section 19-12-100, is shut down at 191 feet.

Mountain Fuel Supply Co.'s No. 1 Hatch, SE NW SW Section 9-11-101, Sugarloaf district, which was drilled to 3,519 feet when it shut down for heavier rig, has suspended operations until spring. The extremely cold weather in that district in the winter, with heavy snows, make it difficult, if not impossible, to move in heavy rotary equipment.

Rocky Mountain Gas Co.'s No. 1 Eberle, SE SW SE Section 9-6n-91, Craig Dome, is standing at 3,830 feet waiting for cement to set. It cemented off a cave at this depth.

Texas Co.'s No. 1 Iles Investment, SE NW Section 23-4n-92, Iles Dome, is coring at 3,350 feet. It is expecting the objective Sundance at about this depth.

S. W. Pressey's No. 1 Ojo, SW NE Section 10-29-69, Oak View district, is drilling at 1,670 feet and preparing to run 6⅝-inch. It had a bad cave at 1,670 feet. The 8¼-inch is at 1,380 feet.

Las Animas County

Mountain States Oil Corp.'s No. 1 Nikola, C NE SE Section 10-34-62, Garcia district, is shut down at 350 feet for water.

WYOMING

Weston County

Another good producer in the west end of the Osage Pool was completed this week in Hugh Updike & Sons' No. 1 Government, NE cor. Section 22-46-64, which found the sand at 1,868-82 feet and flowed 150 bbls. the first 24 hours after a shot. The showing in this sand and surrounding wells completed in the past two weeks point to some good drilling locations outside of the developed territory. The Updike well is a south offset to Federal Oil Co.'s No. 5, which came in last week flowing 125 bbls. per day, and offsets on the west the Butcher lease, upon which Yellowstone Oil Co. last week completed a well flowing 10 bbls. per hour.

Chadron-Osage Oil Co.'s No. 21, SW cor. Section 14-46-64, is ready to drill in after cementing pipe on top of the sand. Riggs Oil Co.'s No. 3, SE NE Section 16-46-64, which is still farther west, is drilling at 2,600 feet. Albert Jones' No. 5, SW NE Section 21-46-63, in the southern part of the shallow pool to the east, is shut down at 260 feet.

Drilling operations in Osage again are being slowed down. This time it is due principally to the uncertainty regarding the allowable outlet for the pool under the NRA code. The allowable at present is 750 bbls. per day. At a meeting of the operators held recently with state officials, it was agreed to recommend an increase in this allowable to 1,200 bbls., but final action by the regulatory board has not yet been announced.

Crook County

Dr. B. R. Kinter and others' No. 1 Rockford-Wyoming, NE SE Section 13-52-62, Rocky Ford district, a test to the

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granite, is at 369 feet, total depth, and preparing to underream the 8¼-inch.

Niobrara County

J. M. Huber Corp.'s No. 1 Joss, NE NW NE Section 5-35-65, Lance Creek, is drilling at 3,315 feet with a show of gas. This is an old well drilling deeper to the Lakota.

Converse County

Continental Oil Co.'s No. 30 Glenrock Sheep, SW SE SE Section 4-33-76, Big Muddy, is drilling at 4,225 feet in new hole in the top of the Muddy after plugging back from the Sundance. It had a show of oil in sand at 4,214-16 feet.

Natrona County

Midway Oil Corp.'s No. 1 Boyer, SW NE NE Section 23-35-79, Midway Dome, is drilling at 3,700 feet.

Park County

Henderson Producing Co.'s No. 5-H-11, NE NE Section 31-58-99, Elk Basin, is an abandoned location. A gas well most likely would be developed at this location and it was decided to drill for oil on another lease on the Montana side. V. M. Kirk's No. 1 Government, SW cor. Section 24-58-98, Frannie Dome, is drilling at 1,632 feet, and Resolute Oil Co.'s No. 1 State, C NW SW Section 16-57-101, Badger Basin, is drilling at 3,000 feet.

Hot Springs County

Empire State Oil Co.'s No. 4 Republic, NE cor. NW Section 14-44-98, Hamilton Dome, is drilling at 1,895 feet, with a show of oil in the Chugwater.

Carbon County

Ohio Oil Co.'s No. 2 A. J. Hazlett, NE NE Section 34-23-79, Allen Lake, showed for 8,000,000 feet of gas per day in the lower Sundance at a total depth of 2,237 feet. Sand was at 2,117-82 feet. Producers & Refiners Corp.'s No. 4 Wertz, SW cor. SE Section 7-26-89, Wertz Dome, is fishing at 3,541 feet, total depth. Earl W. Reeder, Inc.'s No. 1 Union Pacific, C SW SW Section 19-20-83, Overland Dome, is drilling at 2,848 feet. Mutual Oil Syndicate's No. 9 Dutton Creek, NW NE Section 12-18-78, is drilling at 4,765 feet.

MONTANA

Toole County

An oil discovery which holds out possibilities for the opening of another pool in Montana is reported in C. Leonard Smith and others' No. 1, SW cor. SE Section 7-33n-2e, in the East Shelby district, 12 miles north and 15 miles east of the town of Shelby. It is drilling at 1,520 feet and had a good show of oil in the top of the Sunburst at 1,495 feet. The show is estimated at 25 bbls. per day. It had a small show of gas in sandy shale at 380 feet and another at 710-20 feet, followed by a show of oil at 765 feet. The 8¼-inch was cemented at 900 feet and at 1,180-85 feet it cut a sand which made approximately 3,000,000 feet of gas per day, with a pressure under 400 pounds. It topped the Kootenai at 1,190 feet. The well is 2 miles north and 6 miles west of the nearest oil producer. A gas well drilled in the SE cor. Section 12-33-1e, made 1,043,000 feet of gas from a sand member of the Colorado shale at 800 feet and another drilled in the SE Section 17-33-2e, had 1,500,000 feet of gas at 800 feet. C. D. Johnson, of Denver, made the location.

Glacier County

There were no completions reported in the Cut Bank Field. Santa Rita Oil & Gas Co.'s No. 1 Cardwell, C NE SE Section 15-35-6w, in the northern part of the pool, which was reported a completion last week, flowing 300 bbls. the first 24 hours, has settled down to an average of 203 bbls. per day.

Four new locations were released as follows: R. C. Tarrant's No. 3 Emma Britton, C NW SW Section 12-34-6w, is a location; Nadeau Brothers' No. 1 F. E. Van de Mar, C SE NW Section 35-35-6w, is building rig; Montana Power Gas Co.'s No. 1 H. S. Haines, C SE Section 20-35-5w, is rigging up, and Dunstall and others' No. 1 Kennerly, 660 feet from the north line and 550 feet from the east line, NW Section 22-34-6w, is a location.

Alberta-Pacific Consolidated Oil Co.'s No. 3 Matson, SW NW SW Section 14-34-6w, is spudding, and Commonwealth Petroleum Co.'s No. 1 Getty, C NE SW Section 15-34-6w, is building rig. Lou Crumley's No. 1 Billedeaux, NW SE Section 27-35-6w, is rigging up, and W. M. Fulton and others' No. 2 Haggerty, C NW NW Section 15-34-6w, is rigging up.

Montana Headlight Oil Co.'s No. 2 Williams, SW cor. NE Section 11-34-6w, is an abandoned location and new location has been made in the C NE NE of the same section. This followed an agreement among the operators to locate wells in the center of 40-acre tracts for the primary development.

Montana Power Gas Co.'s No. 1 Miller, SW NE NE Section 4-35-5w, is drilling at 2,600 feet, and its No. 2 [illegible]ha, NE cor. NW Section 2-34-6w, is rigging up. Same company's No. 1 Teterud, C W half Section 2-35-5w, is drilling at 1,994 feet with the 10¾-inch on bottom.

Nyhagen-Bell's No. 1 Anderson, SE NE SW Section 26-35-6w, is drilling at 2,325 feet, and Par Oil Co.'s No. 2 Haines, SE cor. SW Section 2-34-6w, is drilling at 1,045 feet.

Santa Rita Oil & Gas Co.'s No. 3 Yunck, C SE SW Section 14-34-6w, has cellar completed. This location was changed from the NE SE SW of the section.

R. C. Tarrant's No. 2 Britton, SW NW SE Section 14-34-6w, is drilling at 1,325 feet, and his No. 1 Carman, C NW NW Section 19-34-5w, is drilling at 1,695 feet. Tarrant's No. 2 Haglund, Sr., C NW NW Section 13-46-6w, is rigging up, and his No. 4 Haglund, Jr., C SE SE Section 13-34-6w, is rigging up. Tarrant's No. 1 Larson, C SW NE Section 12-34-6w, topped the Kootenai at 2,130 feet and is drilling at 2,460 feet. His No. 2 Miller, C SW NE Section 24-34-6w, is fishing for tools at 430 feet, and his No. 1 Winkler, C SW SW Section 23-35-6w, topped the Colorado at 485 feet and cemented the 10¾-inch at 580 feet.

Texas Co.'s No. 1 Fiske, C NW NE Section 14-35-6w, is standing at 2,950 feet, and its No. 1 Yunck, NW SW Section 14-35-6w, has cellar completed. Same company's No. 1 Hinkle, NW cor. NE Section 2-34-6w, is drilling at 614 feet, and its No. 1 Haggerty, SE cor. Section 9-34-6w, is standing with the 10¾-inch cemented at 148 feet, waiting for rotary.

In the South Cut Bank area, Texas Co.'s No. 1 State, C NE Section 16-32-5w, spudded October 12. This is a joint operation with Santa Rita Oil & Gas Co. and Montana Power Gas Co., and is a wildcat. L. R. Hannah and others' No. 1 Peterson, SW NW NW Section 29-32-4w, topped the Colorado at 295 feet and is drilling at 400 feet.

Carbon County

Henderson Producing Co.'s No. 1 Government, SE cor. NW Section 35-9s-23, Elk Basin Field, is a location for a Dakota sand test. It is an offset to a producer in the Frontier which is making 60 bbls. per day.

Liberty County

J. H. Hamilton and others' No. 1 Northern Farms, C NE SW Section 10-37-5e, Flat Coulee, is shut down to finish rigging after spudding. Western Natural Gas Co.'s No. 1 Shaffer, SW cor. SE Section 14-37-4e, Whitlash district, is drilling at 1,250 feet.

SOUTH DAKOTA

Palensky's No. 1, NE NW SW Section 15-95-64, Wagner district, Charles Mix County, is shut down at 2,383 feet, several hundred feet in the Sioux quartzite.

IDAHO

Boise Petroleum Co.'s No. 1 Pence, SE NE SW Section 13-8n-4w, Payette County, is drilling at 2,500 feet.

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Supplemental Code on Oil Production Methods Being Submitted to Operators in California

By L. P. STOCKMAN
Staff Correspondent, California Fields

LOS ANGELES, Calif., Oct. 23.—The Central Proration Committee has just approved a new supplemental production code, designed to clarify the situation in California and prescribe a definite method of procedure with respect to future allocation. California will begin balloting on the supplemental code within a few days and an affirmative vote is anticipated as the Central Proration Committee has carefully considered the code's provisions and approved it before submitting it to operators.

Article 1 of the supplemental code provides that "the emergency in the production of petroleum in California must be met, employment must be increased, and fair and adequate wages established; wasteful depletion of petroleum resources must be prevented; reservoir energy must be properly utilized by subordinating gas production to oil production in an oil and gas pool; unnecessary drilling must be discouraged; land and royalty interests must be considered coincident with operating rights; the principle that subsurface ownerships as well as surface ownerships have inalienable and inviolable rights of property must be recognized and furthered; the pool, in relation to other pools in the same field or district must be considered a distinct entity as a single separate source of supply; in all pools the factors of demand for the quality of oil produced, minimum field requirements, number and depth of all wells must be considered; also in fully developed pools aggregate well potentials, and in partially developed pools the degree of development, average well potential and active drainage area must be given fair consideration; a proper and equitable division and allocation of the state's oil production quota resulting in the production of the required quantities of refinable and nonrefinable oils must be made; and partially developed properties must be protected from drainage, and all properties must enjoy a proper allocation of refinable and nonrefinable oil."

Code Needed

This article indicates the necessity of a supplemental code to accomplish results and assure operators of an equitable distribution of allocations. The provision that reservoir energy must be properly utilized by subordinating natural gas production to oil production is particularly significant in view of the procedure followed out by operators in prolific fields of opening up wells with abnormally high gas-oil ratios during the winter. Under the supplemental code this practice will probably not be tolerated to any great extent, particularly as the Buttonwillow gas field and the Goleta gas field are believed to have ample reserves of dry gas to meet normal requirements. Buttonwillow and Goleta are exclusive gas fields as no crude oil has been developed in either.

One most important provision of the supplemental code is that consideration must be given to the demand for the quality of oil produced and an equitable allocation made on the demand for refinable and nonrefinable oils. The code provides that the state's quota shall be properly divided into a heavy oil quota and a light oil quota and so allocated as to result in the production of the market requirements of refinable and nonrefinable oils as determined at quarterly intervals. Heavy or nonrefinable oil is defined as petroleum of 20° A.P.I. or less, and light, or refinable oil is defined as petroleum of more than 20° A.P.I. This requirement will correct a topheavy condition and prevent producers of light oil from overproducing to the detriment of heavy oil producers, and vice versa. The production of heavy oil will be predicated primarily on the normal demand for fuel oil in markets tributary to the Pacific Coast and large shipments of fuel oil to be made to the Atlantic Seaboard for domestic consumption during the forthcoming year. The normal demand for gasoline on the Pacific Coast and shipments of motor fuel to Atlantic and Gulf Coast ports will be the determining factors in the amount of refinable crude oil that operators in light oil fields will be allowed to produce.

Marginal Wells

Article 7 of the supplemental code provides that "previously shut-in wells, properties and pools shall not be denied the right to resume production; marginal wells, offset wells, or those of the same drainage area shall respect their individual allotments except as authorized by the organization in necessary cases; wells so irremediably affected by water encroachment as to make restricted production impossible shall receive uniform special consideration; the grouping or joining of property interests within a field for operating efficiency, for protection against drainage, or for curtailment purposes may be permitted; the relinquishment of a property allotment in favor of another pool, or the transfer of allotment from nonmarginal wells to other such wells on the same property may be permitted; a reserve allotment for adjustments and for new wells shall be maintained, and such orders necessary to obtain the essential information and to secure full compliance with production quotas shall be issued by the organization to producers, purchasers, transporters, refiners and royalty owners of crude oil produced in California."

This section makes it compulsory for producers, marketers, refiners and others to furnish reports to the umpire or the organization of operators designated to enforce the code. The supplemental code provides that all orders must be obeyed immediately as of the effective date as failure to do so shall be deemed an unfair trade practice and in violation of the code. The Kern River Field and several other similar areas will receive the benefit of Article 7 as Kern River produces under a water drive and operators must maintain steady production to keep ahead of the water.

Enforcement Agency

The supplemental code provides that operators shall select a representative agency to allocate production, although the organization selected shall be subject to the approval of the Secretary of the Interior. In addition to the representative agency of petroleum producers selected to administer the code, the Secretary of the Interior is requested to designate a representative of the Department of the Interior as a contact officer.

The actual method of allocating state production is definitely covered under the new supplemental code. It provides that "there shall be first assigned to each producing well to cover average lifting costs and initial minimum allotment increasing progressively in 100-foot increments from 3 bbls. daily per 1,000 feet of producing depth in a 1,000-foot well to 6 bbls. daily per 1,000 feet of producing depth in a 10,000-foot well, except wells incapable of producing such minimum allotment shall receive an allotment equal to their actual production. The portion of the state quota remaining after the assignment of initial well allotments shall be reserved for allotment to those partially developed properties subject to drainage, each portion being equivalent in percentage to the ratio between the total undeveloped acreage subject to draining and the total acreage subject to drainage as hereinafter defined but in no case exceeding 10 per cent of the state quota remaining after the assignment of all initial minimum allotments.

"Another portion of the state quota, not greater in amount than the total allotment to properties subject to drainage, shall also be reserved for allocation under uniform rules of procedure to wells irremediably affected by water encroachment; to new and recompleted wells; to correct errors and omission and to special cases arising from exceptional conditions. Provided, however, that in no case shall the total allotment reserved for properties subject to drainage and for all other purposes exceed 15 per cent of the state quota."

Eligibility

Property eligible for allotment to compensate for drainage is defined as that included in those square 10-acre tracts of undrilled proved oil land, immediately surrounding the square 10-acre tract upon which a well is located, except in those fields having a wider well spacing agreement where such agreement shall prevail. A partially developed property is defined as one where there are one or more square 10-acre tracts of proved oil land having no well thereon except in those fields having a wider well spacing agreement in which case such agreement shall prevail. The total amount of production reserved for undeveloped areas shall be distributed on an acreage basis by the graduated method according to the average acre potential of the square 10 acres of developed oil land which locates and limits the acreage eligible for allotment participation. The distribution of allotments to partially developed properties subject to drainage shall be classified as to refinable and nonrefinable oil and the sum total allotment of each class of oil shall be subtracted from the total quota of each class remaining after the assignment of minimum well allotments to determine the amount available for subsequent allocation.

The remaining quota of each class of oil shall be allocated to individual or average wells by the graduated method on the basis of the uniformly determined normal individual or average well potential remaining after subtracting the amount of the initial minimum allotment from the total potential thereof. The graduated method restricts the potential production of a large well to a greater relative degree than that of a small well in accordance with a mathematical curve determined from the average potential and allotment of all wells of the state. The total allotment of any property shall be the sum of the allotments assignments in accordance with prescribed procedure. New fields or pools to be developed in accordance with plans approved shall receive allotments as provided for in this code. The base formula is subject to amendment or change with the approval of the Secretary of the Interior. A pool is a single oil and/or gas deposit constituting one separate source of supply.

Huntington Beach

The state was unsuccessful again this week in its attempt to determine the status of wells producing oil and gas from beneath state tidelands adjacent to the Huntington Beach Field when Judge L. N. Turrentine continued the case in the Superior Court of Santa Ana until November 7, upon an affidavit that the defendants are not the owners or lessees of the land on which the well is located.

State officials are expected to recommend leases between the state and operators producing beneath state tidelands.

TANKER SHIPMENTS FROM LOS ANGELES TO DOMESTIC AND FOREIGN PORTS

	Oct. 7		Sept. 30			
Intercoastal-domestic—	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Fuel oil	89,983	12,855	141,364	20,195	1,150,649	.... ..
Diesel and gas oil	.. ..	.....	.....	.....	1,200,559	763,622
Gasoline	624,336	89,191	.....	....	8,708,526	6,558,675
Kerosene	.....	.....	29,660	4,237	618,966	154,372
Foreign exports—						
Crude oil	73,754	10,536	24,903	3,272	5,748,620	6,481,158
Fuel oil	85,167	12,167	127,748	18,250	6,333,292	6,635,549
Diesel and gas oil	.....	...	.....	.....	2,501,433	1,909,237
Gasoline	62,238	8,891	19,733	2,819	4,450,002	6,515,246
Kerosene	56,744	8,106	26,908	3,844	1,564,965	2,321,658
Naphtha distillates	.....	.....	.....	.....	.....	130,975
Coastwise-domestic—						
Crude oil	.....	....	.....	.....	5,627,398	11,315,254
Fuel oil	252,442	36,043	152,862	21,837	7,910,466	9,233,719
Diesel and gas oil	.. ....	....	23,041	3,292	839,570	979,284
Gasoline	280,333	40,048	232,737	33,248	9,949,769	11,780,495
Kerosene	.....	.....	4,055	579	153,320	132,093
Naphtha distillates	.....	.....	.....	.....	27,651	.....

TANKER SHIPMENTS FROM SAN FRANCISCO TO DOMESTIC AND FOREIGN PORTS

Intercoastal-domestic—						
Diesel and gas oil	.....	.....	111,819	15,974	511,897	556,606
Gasoline	.....	.....	28,713	4,102	804,548	844,423
Kerosene	.....	.....	.....	...	482,430	152,611
Lubricants	.....	....	393	56	23,934	23,829
Foreign exports—						
Crude oil	46,180	6,597	176,065	25,152	1,542,286	707,651
Fuel oil	110,471	15,782	233,791	33,399	1,384,811	795,098
Diesel and gas oil	.....	.....	10,807	1,544	835,257	519,332
Gasoline	92,506	13,215	24,236	3,462	3,279,816	2,992,842
Kerosene	.....	.....	31,520	4,503	841,225	768,230
Lubricants	.....	.....	5,102	729	101,472	30,094
Coastwise-domestic—						
Fuel oil	127,141	18,163	181,833	25,976	2,874,900	2,427,892
Diesel and gas oil	10,073	1,439	.....	...	189,323	321,433
Gasoline	282,932	40,419	47,321	6,760	3,228,427	2,920,732
Kerosene	.....	.....	.....	.....	95,204	91,723
Lubricants	.....	.....	.....	.....	2,751	.....

but the Standard Oil Co., Pacific Electric Railway and Huntington Beach Co. are expected to contest such action in as much as the wells in question must drill through properties of these companies to intercept the producing zone beyond the high tide line.

New Wells

The best well finished in the Huntington Beach Field during the week was E. K. Allison's No. 1-A McClure, bottomed at 5,268 feet and finished with a 4¼-inch liner carrying 312 feet of perforated and cemented through perforations at 4,956 feet. This well registered an initial of 3,205 bbls. of 24.9 gravity oil but was beaned back to approximately 300 bbls. F. A. Burkett's No. 1 fee in the Seventeenth Street town lot area, came in as a gas well but was shut in as it did not produce any oil. Huntington Beach Co.'s No. 4 was good for 915 bbls. of 25.1 gravity oil per day on a compressor. This well was bottomed at 4,500 feet and finished with a 5¾-inch liner including 500 feet of perforated. Standard Oil Co. conducted production tests on two wells in the Seventeenth Street town lot area but both required artificial stimulation and compressors were installed. No. 64-B showed an initial of 183 bbls. of 21.6 gravity oil per day from 4,350 feet while No. 17 Pacific Electric was brought in doing 344 bbls. of 24.1 gravity oil per day from 4,324 feet. Both wells, unlike other recent completions in the town lot area, were drilled as nearly perpendicular as possible. Standard has four other wells under way in the area and is rigging up another, No. 20 Pacific Electric. Wilshire Oil Co. has concluded drilling on No. 33 Huntington Beach at 4,550 feet and is expected to make a production test within a day or so.

Richfield

A rather careful check of drilling costs tends to indicate that operators exploiting the Breen zone in the Richfield district will do well if they wind up in the black. Unless deeper drilling is productive of more satisfactory results, preliminary figures indicate only a relatively few operators will show a profit. Very few wells have shown a sustained production due to the lack of sufficient gas pressure. The Breen zone is exceedingly spotty and uniformly irregular. Allied Petroleum Corp.'s No. 11 is pumping only 46 bbls. per day from 3,777 feet and Crystal Gasoline Corp.'s No. 3 Richfield is doing only 44 bbls. daily. Otis Hoyt's No. 15 is pumping 88 bbls. daily, No. 2 Mann of Long Beach Petroleum 32 bbls. daily, J. O. Seeple's No. 2 doing 96 bbls. daily and No. 1 McCracken of Standel Oil Co. 77 bbls. per day.

Plymouth Oil Co. has completed No. 1 Goodyear in the Long Beach Field flowing 777 bbls. of 26.9 gravity oil and 695,000 feet of gas from 7,595 feet. This well, on property subleased from Signal Oil & Gas Co., is apparently producing from the upper part of the hole as Plymouth was successful only in redrilling to 5,320 feet and landing a 6¼-inch liner at 5,321 feet. Axis Oil Co. has recompleted No. 1-A Woods after redrilling and deepening the hole to 4,375 feet, and this rejuvenated producer was returned to production pumping 161 bbls. of 27.1 gravity oil per day. Delaney Petroleum Co.'s No. 1 Daly was recompleted on the beam pumping 392 bbls. of 27.6 gravity oil per day after the hole, bottomed at 5,975 feet, had been redrilled and cleaned out to 5,144 feet. State Co.'s No. 1 Butler has been completed pumping 112 bbls. of 29.1 gravity oil per day after this 7,101-foot hole had been redrilled to 5,194 feet.

Mountain View

Another few weeks should determine the general trend of the Mountain View Field of Kern County as several wells are nearing critical depth. Barnsdall Oil Co.'s No. 1 Mott has proven a disappointment as it tends to indicate an ab-

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well and location—	S.T.R.	Depth	Status:
Monterey Expl. Co., No. 1 Point Concepcion, Sant Barbara	33- 5-33	3,653	plug back
Lincoln Drlg. Co., No. 3 Summerland, Santa Barbara Co.	21- 4-26	1,995	rd. sh. drilling
Meganos Oil Co., No. 1 Purisima, Santa Barbara Co.	28- 8-34	2,861	br. sh. drilling
Barnsdall-Rio Grande, No. 8 Doty Elwood, Santa Barbara	15- 4-29	3,710	deep test
Signal O. & G. Co., No. 2 Elwood, Santa Barbara Co.	tideland	4,797	deep test
Cuyama Oil Co., No. 1 Cuyama, Santa Barbara Co.	12-10-27	3,670	gr. sd. drilling
Indian Pet., No. 1 Shude, Ventura Co.	tideland	3,484	will deepen
Woodrow Pet., No. 1 Rincon, Ventura Co.	4- 3-24	7,602	cleaning out
Hancock Oil Co., No. 1 Fillmore, Ventura Co.	13- 4-19	2,373	will deepen
Oil Ridge Oil Co., No. 1 Fillmore, Ventura Co.	1- 4- 9	rig	suspended
Driggs Pet., No. 1 South Mountain, Ventura Co.	17- 3-20	1,880	sd. sh. drilling
Kneiper & Atha, No. 1 Bardsdale, Ventura Co.	7- 3-19	1,100	gr. sd. drilling
Williamson & Donaher, No. 1 Simi, Ventura Co.	36- 3-18	801	cemented
Dabney, H. R., No. 1 Simi, Ventura Co.	22- 3-18	1,000	suspended
C. C. M. O., No. 3-A Miguelito, Ventura Co.	23- 3-24	4,166	suspended
Midlands Pet., No. 1 Ojai, Ventura Co.	9- 3-23	7,841	C/P 5,522-6,512
Wilshire Oil Co., No. 1 Sulphur Mountain, Ventura Co.	20- 4-21	2,198	suspended
Kirk, W. A., No. 1 Sulphur Mountain, Ventura Co.	21- 4-21	915	br. sh. drilling
Mosher, J. W., No. 1 Santa Paula, Ventura Co.	22- 4-21	1,570	suspended
Las Posas Pet., No. 1 Las Posas, Ventura Co.	22- 3-20	5,000	suspended
International Oil Developers, No. 1 Conejo, Ventura Co.	33- 3-20	3,843	redrilling
Hub Pet. Co., No. 1 Gould Hills, Kern Co.	22-29-21	6,840	suspended
Purman, T. H., No. 2 Gould Hills, Kern Co.	27-29-21	335	suspended
Casa Mira Oil Co., No. 1 Belridge, Kern Co.	29-28-20	5,000	gr. sh. drilling
General Pet., No. 1 Belridge, Kern Co.	30-28-21	9,100	br. sh. drilling
Cumberland Oil Co., No. 2 Devils Den, Kern Co.	17-26-18	3,270	suspended
Lincoln Pet., No. 1 Devils Den, Kern Co.	10-25-18	2,172	suspended
Hanna, Tom, No. 1 Devils Den, Kern Co.	25-25-18	3,516	suspended
Pyramid Hills Oil Co., No. 1 Devils Den, Kern Co.	24-25-18	4,140	test W.S.O.
Fowler, F., No. 1 Blackwell Corner, Kern Co.	15-26-19	3,170	suspended
Associated, No. 1 Lost Hills, Kern Co.	2-26-20	6,041	to set pipe
Howells Bros., No. 1 Round Mountain, Kern Co.	32-28-29	1,260	br. sh. drilling
Kern Pet. Co., No. 1 Lerdo, Kern Co.	14-29-27	4,531	suspended
Ohio Oil Co., No. 1 Buena Vista Lake, Kern Co.	31-31-26	141	sd. drilling
Caravel Pet. Co., No. 1 Edison, Kern Co.	19-30-30	1,891	suspended
Union Oil Co., No. 1 Union Avenue, Kern Co.	15-30-28	2,786	sd. sh. drilling
Alta Oil Co., No. 1 Union Avenue, Kern Co.	4-30-28	3,020	sd. sh. drilling
Shell Oil Co., No. 1 Mountain View, Kern Co.	29-30-29	5,910	resume work
Shell Oil Co., No. 2 Mountain View, Kern Co.	29-30-29	5,838	rig pump
Hogan Pet. Co., No. 2 Mountain View, Kern Co.	29-30-29	5,750	sd. sh. drilling
Bankline Oil Co., No. 1 Mountain View, Kern Co.	4-31-29	5,950	cemented
Barnsdall Oil Co., No. 1 Mountain View, Kern Co.	31-30-29	6,360	sd. sh. drilling
Long Beach Pet., No. 1 Mountain View, Kern Co.	29-30-29	5,680	sd. sh. drilling
Mohawk Pet., No. 2 Mountain View, Kern Co.	30-30-29	5,669	rig compressor
Mohawk Pet., No. 3 Mountain View, Kern Co.	30-30-29	4,400	sd. sh. drilling
Camanche Oil Co., No. 1 Comanche, Kern Co.	15-32-29	rig	suspended
Badger Oil Co., No. 1 Wheeler Ridge, Kern Co.	31-11-19	4,453	suspended
Gatton & Luethe, No. 1 Madera, Madera Co.	32-10-17	3,020	suspended
Russ Oil Synd., No. 1 Kingsburg, Fresno Co.	20-12-21	3,376	gr. sh. drilling
Bergman, Harry, No. 1 Kingsburg, Fresno Co.	12-12-21	4,379	fish D/P
Graham & Loftus, No. 1 Raisin City, Fresno Co.	20-15-18	5,906	suspended
Emerich Oil Co., No. 1 Menoota, Fresno Co.	35-13-13	3,820	suspended
Western Gulf, No. 1 S. P., Fresno Co.	3-17-15	6,011	sd. sh. drilling
Roscoe, D. L., well No. 1, Fresno Co.	36-16-14	rig	suspended
Hogan Pet. Co., No. 1 Joaquin Ridge, Fresno Co.	28-20-16	6,605	suspended
Superior Oil Co., No. 1 Jacalitos, Fresno Co.	6-22-16	5,538	to set pipe
Kent & McDonald, No. 1 Carrizo Plains, San Luis Obispo	3-32-22	3,830	suspended
Paso Robles Oil Co., No. 1 Edna, San Luis Obispo Co.	27-27-11	4,191	suspended
Queen, E. B., No. 1 Corcoran, Kings Co.	7-21-21	6,197	suspended
Brown, A. M., well No. 3, Kings Co.	16-23-19	1,205	suspended
Knudsen & Schmidt, No. 1 Reef Ridge, Kings Co.	36-23-17	6,878	suspended
Dudley Dome Oil Co., well No. 2, Kings Co.	9-23-20	370	cemented
Magee & Stone, No. 2 Alpaugh, Kings Co.	33-21-22	3,149	suspended
Cardinal Oil Co., No. 1 Los Banos, Merced Co.	35-16- 9	rig	rigged up
Na-Pa Oil Co., No. 1 Griffith, Napa Co.	7- 8- 3	3,750	suspended
Oakdale Oil Co., No. 1 Oakdale, Stanislaus Co.	5- 2-10	4,760	hd. sh. drilling
Pacific Northern Oil Co., No. 1 Guinda, Yolo Co.	23-12- 3	5,220	cemented
Buttes Oilfields Co., No. 1 Marysville, Sutter Co.	35-16- 1	2,731	gas—shut in
Buttes Oilfields Co., No. 2 Marysville, Sutter Co.	34-16- 1	3,708	sd. sh. drilling
Tehama Pet. Co., well No. 1, Glenn Co.	4-22- 5	4,696	cemented

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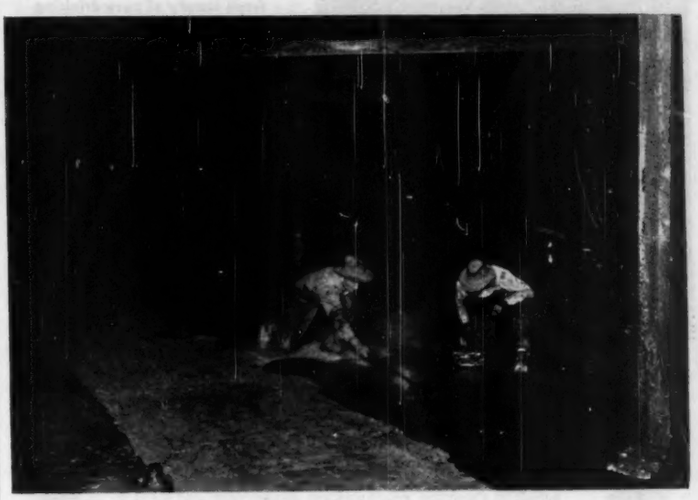

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normal dip in the productive formation. No. 1 Mott is only a few locations west of Hogan Petroleum Co.'s discovery well and appeared almost assured of production. This well, however, is more than 500 feet deeper than the discovery well and has not yet picked up a sufficient thickness of oil sand to justify a production test. Shell's No. 2 Porter Day presents an even more perplexing condition as it is a direct offset to Hogan Petroleum Co.'s discovery, which is flowing 340 bbls. of 34.3 gravity oil and 500,000 feet of gas per day. Shell resumed work on No. 1 Porter Day and succeeded in stimulating a flow of 44 bbls. of 24.2 gravity oil.

No. 1 Porter Day is really the discovery well in the Mountain View Field, although technically this credit goes to the Hogan Petroleum Co. as its No. 1 Wharton was the first commercial producer finished. Shell could have opened up this field two or three years ago if it had decided to finish No. 1 Wharton as it showed an initial production of approximately 1,500 bbls. Shell had considerable acreage tied up in the Mountain View Field and, faced with the necessity of spudding in approximately 15 wells simultaneously, decided to conduct a deep test before sanctioning this large outlay. No. 1 Porter Day was carried down to 8,419 feet but plugged back to 5,910 feet following the failure to pick up a sufficient thickness of oil sand in the bottom of the hole to result in commercial production. Efforts to recomplete No. 1 Porter Day have proved unavailing, although Shell has recompleted the well flowing at the rate of 44 bbls. per day. The status of No. 1 Symons of Bankline, No. 1 Mott of Barnsdall and No. 1 Porter Day of Shell appears to indicate that the main portion of the Mountain View Field lies southeast of the discovery well.

Kettleman Hills

Kenda's No. 83-30-J, completed last week, subsequently established a potential daily production of 10,038 bbls. of 35.2 gravity oil and 8,511,000 feet of gas and stands out as the best well finished in the Kettleman North Dome Field for several months. Kettleman North Dome Association has several other potential producers nearing completion in the North Dome and one or two should be tanking oil within 10 days. In the Mount Poso Field of Kern County, Pacific Western Oil Co. has recompleted No. 3 Glide doing 1,151 bbls. of 15.7 gravity oil per day from 1,797 feet. This well picked up the top of the second Vedder zone at 1,643 feet and the hole was completed with an 8⅝-inch combination string including 158 feet of perforated and cemented through perforations at 1,640 feet.

In the South Belridge Field of Kern County, General Petroleum has just passed the 9,100-foot level in No. 1 Berry, a deep test being drilled to determine the possibility of developing commercial production in the Temblor, or Eocene, production. Up to the present this well has been practically devoid of any unusually promising indications, and has not yet drilled entirely through the brown shale which overlies the Temblor. In the Lost Hills Field of Kern County, Associated Oil Co. has landed and cemented a string of 11¾-inch casing in No. 1 Williamson, a joint project being drilled in conjunction with other operators, and should resume drilling during the week.

Michigan Fields

(Continued from Page 106)

Township, and W. J. Wilson's No. 1 Beach, Section 17, Richland Township. Dapar Oil Co.'s No. 1 Tedam, Section 5, Emerson Township, is the only Gratiot County test now active.

Newaygo Prospecting Co.'s No. 1 Ichenberg well in Section 16-16n-12w, Newaygo County, is reported drilling at 3,300 feet after encountering a show of oil and gas in the Upper Traverse limestone. This is the oldest active well in the State, having been started in 1924 and drilled at intervals since. It will be carried to the Dundee. In the same county, Newaygo Oil & Gas Co. has a bad fishing job in its No. 1 A. J. Bates, Section 12, Sherman Township, at 6,555 feet. This is the deepest test drilled in the State.

A new proration schedule was made effective this week in Michigan retaining the minimum or exemption of 100 bbls. a well but changing from a graduated scale to 30 per cent production on all wells rated at more than 100 bbls. a day potential. While theoretically the order was announced by the new Michigan Oil Regulatory Board to be effective for all pools, the one principally affected will be the flush Porter Pool which was increased to an aggregate potential of about 69,000 bbls. a day by this week's completions. The rest of the State is estimated to be making from 12,000 to 15,000 bbls. a day with few wells exceeding the 100-bbl. exemption. This gives the State a potential of more than 80,000 bbls. a day compared with an allowable of only 30,000 bbls. under the code.

TRUCK RULING TO BE ENFORCED

SPRINGFIELD, Ill., Oct. 23.—Of interest to oil companies is the announcement by the department of finance that it will enforce the recent ruling prohibiting interstate truck and bus operators without a distributor's license from entering the State carrying more than 20 gallons of gasoline. Violators will be prosecuted after November 1. Officials say trucks have entered the State with 250 gallons to avoid paying tax on gasoline purchased in this State. Illinois filling station operators have lost much business thereby, it is asserted.

EAST TEXAS FIRE

The Gregg-Tex Gasoline Corp.'s new gasoline plant in the Longview area, Gregg County, was damaged by an explosion on October 19. Jack Thomas, one of the operators, died that night from injuries received in the blast. Five others were injured. The plant was completed but a week ago and was still operating under trial conditions.

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Company, well and location—	S.T.R.	Depth	Status:
Palm Ridge Oil Co., No. 1 Palms, Los Angeles Co.	2- 2-15	7,150	suspended
Pacific Gulf, No. 1 Athens, Los Angeles Co.	19- 2-13	6,034	suspended
Pacific Dev. Co., No. 1 Wilmington, Los Angeles Co. ..	16- 3-13	901	cemented
Wilmington Oil Co., No. 1 Wilmington, Los Angeles Co.	28- 4-13	4,516	suspended
Sunrise Pet. Co., No. 1 Dominguez, Los Angeles Co.	3- 4-13	5,250	repair mach.
Kelly & Son, No. 1 Torrance, Los Angeles Co.	7- 4-13	mtl.	building rig
Baldwin Hills Pet., No. 2 Inglewood, Los Angeles Co. ...	17- 2-14	mtl.	building rig
Oakes & Mead, No. 1 Lyndwood, Los Angeles Co.	31- 2-12	4,940	remaing
Celito Oil Co., No. 1 Monterey Park, Los Angeles Co. ...	25- 1-12	5,319	cemented
Community Oil Co., No. 1 Montebello, Los Angeles Co.	34- 1-11	5,281	suspended
Universal Consd., No. 2 Montebello, Los Angeles Co. ..	5- 2-11	2,503	sd. sh. drilling
Universal Consd., No. 3 Montebello, Los Angeles Co. ..	5- 2-11	1,147	sd. sh. drilling
Nance, M. K., No. 1 Montebello, Los Angeles Co.	6- 2-11	rig	suspended
Signal Pet., No. 1 Puente, Los Angeles Co.	14- 2-10	4,905	testing
Recovery Oil Co., No. 1 Sunset Beach, Los Angeles Co.	16- 5-11	1,615	sd. sh. drilling
Willetts Pet., No. 1 Saugus, Los Angeles Co.	35- 6-16	2,074	suspended
Alpha Oil Co., No. 1 Calabasas, Los Angeles Co.	22- 1-18	1,317	suspended
Marbie, Willard, No. 1 Van Nuys, Los Angeles Co.	6- 2-16	3,760	suspended
Plymouth Oil Co., No. 1 West Coyote, Los Angeles Co.	24- 3-11	5,260	hd. sd. drilling
Vaqueros Major Oil Co., No. 1 Huntington, Orange Co...	tideland	rig	suspended
Nuoll Co., No. 1 Newport, Orange Co.	29- 6-10	5,090	br. sh. drilling
Mineral Exploration, No. 1 Capistrano, Orange Co.	3- 8- 7	4,302	suspended
Saddleback Oil Co., No. 1 El Tora, Orange Co.	3- 6- 7	80	suspended
Placentia Dev. Co., No. 1 Placentia, Orange Co.	31- 3- 9	3,170	sd. sh. drilling
Brown, W. F., No. 1 Atwood, Orange Co.	26- 3- 9	rig	suspended
Rubens, Sy, No. 1 Atwood, Orange Co.	19- 3- 9	406	sd. drilling
Bartholomae Oil Co., No. 1 Coyote, Orange Co.	32- 3-10	rig	rigging up
Spindle Top Oil Co., No. 1 Salton Sea, Riverside Co. ..	25- 7-10	3,550	suspended
Great American Pet., No. 1 Chino, San Bernardino Co...	18- 2- 8	2,660	fish D/P
Great American Pet., No. 2 Chino, San Bernardino Co...	18- 2- 8	1,550	fishing
McCarthy, C. F., No. 1 Chino, San Bernardino Co.	14- 3- 6	803	sd. sh. drilling

Kansas Allowable Cut to 87,000 Bbls. to Make Up 300,000-Bbl. Overage in September

By JAMES McINTYRE

The Kansas Corporation Commission reversed itself in the past week when it announced that producers may disregard that part of the commission's earlier order which required the owners of all overproduced properties to shut in their wells 100 per cent. The commission on Saturday sent the following telegram to all the purchasers in the State:

"Due to the delayed receipt of September production reports the commission ordered all overproduced properties shut down in its order of October 17, while making up the 300,000-bbl. average of September.

"Receipt of the delayed reports and the rate of production by runs indicates this overproduction can be made up this month without shutting down properties, and averages or shortages can be equalized after new potentials.

"You are authorized to disregard paragraph 6 in order No. 33-10-17 and continue taking production at 75 per cent of allowables as fixed in order No. 33-10-9."

Allowable Cut to 87,000 Bbls.

The Corporation Commission after a hearing earlier in the week on the question of a revision of the production allocation in that State, ordered that for the period beginning at 7 a. m. on October 18, and for 12 days thereafter, the allowable production of crude oil from all pools in the State is restricted to 75 per cent of the previously published allowable. This should bring production in the State down to 87,000 bbls. during the period given.

Secretary of the Interior Ickes had called attention of the commission to the fact that Kansas had overproduced 300,000 bbls. between September 8 and 30 inclusive and that this overproduction must be equalized in October.

The commission then gave out the following statement to clarify the situation:

"A complete misunderstanding seems to have been caused by some people believing that their overproduction will be eliminated by this order reducing Kansas production 25 per cent for 12 days. No overproduced property will be given any credit by underproduction of another property and all overproduced properties will carry their overproduction plus this 25 per cent further cut until equalized in exactly the same manner as if Kansas Federal allocation had been reduced from 116,000 bbls. daily to approximately 87,000 bbls. daily for the 12-day period.

"All overproduced properties will remain shut down until equalized. The additional oil required to fill quota of the field will be given to the leases producing within their allowable until all properties may be returned to their regular allocated quotas.

"This order merely reduces normal allowables about three days for the 12-day period and stops further taking of the Kansas market by overproduction from those producing their allowables.

"This order applies a 25 per cent reduction to the October allowable of all wells regardless of size from a fraction of a barrel to the largest."

It was the second paragraph in the above quoted statement(referring to overproduced properties shutting down) that was rescinded by the commission. The production cut to 87,000 bbls. per day until the 300,000-bbl. overproduction is made up, stands as ordered.

Kansas in the week ending October 21 produced 114,290 bbls., which was under its 116,000-bbl. allowable, but which will have to be shaved down over 27,000 bbls. per day for a while.

Field developments in the past week were devoid of features. Routine completions, and even a scarcity of these as compared with other recent weeks, characterized the reports from the fields and new operations were fewer than usual.

Attention was called to the importance of the McPherson district as an oil region when it was made known that of the total one-day potential production of Kansas, which is 235,696 bbls., the McPherson area is credited with 102,060 bbls. The McPherson district as given here includes the pools in Harvey as well as McPherson County. There are 428 wells in the district. They are flush and semiflush wells.

Production of Pools

Following is the estimated average daily production of some of the more prominent pools and fields in Kansas in the week ending October 21 and the previous week:

Pool or field—	Oct. 21	Oct. 14
Hollow	7,734	6,210
Rlix-Canton	18,265	18,795
Voshell	6,440	5,950
Sedgw'ck County	9,375	9,260
Nikkell	3,304	2,420
Ellsworth County	3,710	4,073
Rice County	7,498	5,544
Barton County	497	436
Reno County	1,436	1,648
Ellis County	459	827
Kingman County		662
Stafford County	823	635
Russell County	2,855	2,500
Greenwood County	11,300	11,400
Butler County	18,250	18,100
Other pools	22,344	23,810
Total	114,290	112,270

Harvey County

In the Hollow Pool in Harvey County, Shell Petroleum Corp.'s No. 1 V. Neufeldt, SE SW NW Section 8-22-3w, made 100 bbls. in one hour from chat topped at 3,166 feet, total depth 3,206 feet. It was shut in. Shell Petroleum Corp. which acidized No. 2 Nikkell, NE SW SW Section 8-22-3w, with no results was drilling at 3,386 feet, after setting 5-inch casing at 3,369 feet.

Derby Oil & Refining Co. completed No. 4 Schmidt, NE SW NW Section 17-22-3w. It had been drilled to Siliceous lime at 3,648-57 feet, and made a hole full of water. It was plugged back to 3,447 feet and acidized and produced 5 bbls. per hour on gas lift.

Hollow and others' No. 4 Schmidt, NW SE NW Section 17-22-3w, swabbed 138 bbls. in six hours from pay at 3,443-54 feet. It was then acidized.

Sinclair Prairie Oil Co.'s No. 3 Neufeldt-A, SE cor. Section 18-22-3w, was completed. It pumped 460 bbls. in 20 hours from pay at 3,460-86 feet, Hunton lime.

Producers & Refiners Corp. completed No. 2 Martens, SE SW SE Section 19-22-3w. It pumped 822 bbls. in 24 hours. It was an old Wilcox sand well deepened. Same company's No. 6 Martens, NW SW SE Section 19-22-3w, was completed. It pumped 612 bbls. in 24 hours from Hunton pay at 3,345-70 feet. Same company's No. 7 Martens, SW SE Section 19-22-3w, with Hunton lime from 3,334-64 feet, was given an acid treatment and flowed 1,302 bbls. the first 24 hours. Liner will be run and it will be drilled to the Wilcox sand.

Sinclair Prairie Oil Co.'s No. 4 Ediger, SE SW Section 19-22-3w, swabbed 14 bbls. per hour from Hunton at 3,321-61 feet and was then treated with acid and swabbed 730 bbls. in 18 hours. Drilling was resumed and it was at a total depth of 3,419 feet.

Shell Petroleum Corp. was rigging up No. 2 Voth, NE NW Section 4-22-3w; J. E. Mabee, Inc., and Shell Petroleum Corp. set 15-inch pipe at 470 feet in No. 1 Nikkell-B, SW cor. Section 8-22-3w, and was rigging up No. 1 Nikkell-A, SW SE SW Section 8-22-3w.

McPherson County

J. E. Mabee, Inc., and Shell Petroleum Corp.'s No. 1 Friesen, NW SW SE Section 33-21-3w, McPherson County, was completed. It pumped 1,424 bbls. in 24 hours from Hunton pay at 3,468-78 feet.

Dickey Oil Co. and Indian Territory Illuminating Oil Co.'s No. 1 Gray, NW SE Section 2-20-3w, which had swabbed 75 bbls. in six hours, pumped only 30 bbls. in 12 hours. It is a chat producer from 3,015-60 feet.

Cartwright & Prunty's No. 1 Jones, SE SW NW Section 26-19-3w, was a hole full of water at 3,370 feet and was shut down for orders.

Mabee, Inc., and Shell Petroleum Corp. had rig up for No. 4 Friesen, SE SW Section 33-21-3w; same operators will drill deeper in No. 1 Nikkell, NE SW Section 33-21-3w, and acidize. Sinclair Prairie Oil Co. was rigged up on No. 6 McCurdy, SE NE SE Section 24-20-3w. Texas Co. will deepen No. 4 Munn, SE NE NE Section 12-20-3w, old total depth 2,988 feet. Shell Petroleum Corp. has rig up for No. 5 Meyers-B, SE cor. Section 14-19-2w. Gypsy Oil Co. was drilling at 823 feet in No. 3 Lovett, NW cor. Section 24-19-2w. Youker and others had rig up for No. 7 Eaton, NW NE NE Section 26-19-2w.

Rice County

In Rice County, Langston and others have ponds dug preparatory to starting a wildcat test, No. 1 Markle, NE cor. SW, Section 1-20-9w.

In the Chase Townsite Pool, Ramsey and others' No. 1 Saint, SE NE SE Section 31-19-9w, swabbed 418 bbls. in four hours from Siliceous lime at 3,226 feet, drilled in 10 feet.

Keith and others reacidized No. 1 Willis, NW NW SE SW Section 32-19-9w, and it pumped 83 bbls. in 12 hours.

Ramsey Brothers swabbed two days and exhausted the water in No. 1 Beyer, Block 5, Section 32-19-2w, and then put the well on the pump. It made 1,205 bbls. of oil in 24 hours and was completed. Siliceous lime was topped at 3,235 feet, total depth 3,251 feet.

Slick, Pryor & Lockhart and others' No. 2 Herzog, NW NE SE Section 27-18-10w, found pay at 2,680-85 feet. It swabbed 147 bbls. in 36 hours and will be acidized.

Ellis County

Davis, Hazlett and others' No. 1 Wieland, SE NW NE Section 1-13-16w, Ellis County, pumped 50 bbls. of oil and 4 bbls. of water in 24 hours from Oswald lime at 3,055-63 feet. It will be acidized.

Greenwood County

Markus & Gore have a 220-bbl. initial production after a shot in No. 3 Smith, NE SW NE Section 6-24-12, Greenwood County. They have made location for No. 4 Smith.

Anderson & Pence's No. 1-A Adams, SW NE SW Section 17-24-13, pumped 8 bbls. from a break in the Mississippi lime

(Continued on Page 130)

Wildcat Operations in Kansas

Week Ending October 21

(Descriptions are East unless marked otherwise)

BARTON COUNTY

Company, farm and location—	Remarks:
Atlantic O. P. Co.'s No. 1 Schneider, C NE SW Sec. 15-20-13w	Drlg. 2,215 ft.
Gypsy Oil Co.'s No. 1 Soderstrom, SE NE NW Sec. 21-17-13w	Drlg. 380 ft.
Helmerich & Payne's No. 1 Everleigh, C SW SE Sec. 13-18-13w	T.D. 2,490 ft.; fishing.
Skelton et al's No. 1 Ott, C SE SE Sec. 16-19-14w	O.W.D.D.; T.D. 3,706 ft.; P.B. to 3,255 ft.; bailing wtr.

BUTLER COUNTY

Hartman et al's No. 1 McCann, SE SW NW Sec. 7-25-3.	Re-acidized; pumped 40 bbls. oil and some wtr. in 24 hrs.; comp.

COWLEY COUNTY

Yarnell et al's No. 1-A Speer, SE NE NE Sec. 21-33-4e.	U.R. 6-in. csg.; T.D. 2,210 ft.
Van Meter et al's No. 1 Moore, NE cor. Sec. 5-35-4	Rig on ground.

EDWARDS COUNTY

Atlantic Oil Prod. Co.'s No. 1 Bradbridge, C SE NW Sec. 1-24-16w	T.D. 3,715 ft.; R.U. cable tools.

FINNEY COUNTY

National Ref. Co. et al's No. 1 Smith, C SE SW Sec. 3-23-29w	S.D. for wtr. at 2,104 ft.

HARVEY COUNTY

Holbart Oil Co.'s No. 1 Harder, SE SW SE Sec. 11-21-1e	Drlg. 2,754 ft.
Holbart Oil Co.-Shell Pet. Corp.'s No. 1 Gingras, NE SW Section 8-24-1e	Drlg. 2,543 ft.
L. H. Wents' No. 1 Bestvater, SW SE SW Sec. 8-22-1e.	H.F.W. 3,034 ft.; S.D.

KINGMAN COUNTY

Olson and Skelly Oil Co.'s No. 1 Emery, C SW NW Sec. 22-25-6w	Set 8-in. 3,509 ft.; T.D. 3,514 ft.
Regina O. & G. Co. et al's No. 1 Wilson, NW NE Sec. 26-25-5w	T.D. 3,646 ft; R.U. cable tools.

McPHERSON COUNTY

Dieter et al's No. 1 Carlson, SE cor. Sec. 4-18-3w	O.W.D.D.; drlg. 3,113 ft.
Regina O. & G. Co.'s No. 1 Vogts, C SE SE Sec. 3-20-1w	Drlg. 3,190 ft.
Jim Madison's No. 1 Boesker, SE NW Sec. 29-20-1w.	Spudded.
Paramount Oil Co.'s No. 1 Steinkirchner, NE SE SE Sec. 25-19-1w	T.D. 2,525 ft.; U.R. 8-in. pipe.

RENO COUNTY

Mylius et al's No. 1 Patton, SE NE Sec. 35-23-5w	H.F.W. 3,911 ft.; abd.
Roth & Faurot's No. 1 Yoder, C NW NW Sec. 15-24-5w.	Rigging up rotary.

RICE COUNTY

Atlantic Oil Prod. Co.'s No. 1 Brandenstein, C SE SE Sec. 10-19-10w	Drlg. 1,000 ft.
El Dorado Ref. Co.'s No. 1 Wernet, SW NE Sec. 12-20-6w.	Spudding.
Elmer Corn et al's No. 1 Hunter, NE cor. Sec. 35-19-7w.	Rig on ground.

RUSSELL COUNTY

Western Exploration Co.'s No. 12 Durr, SW cor. Sec. 30-15-12w	Spudding.

SEDGWICK COUNTY

Wentz et al's No. 1 Stockamr, SW NE Sec. 31-26-2w.	Spudding.

STAFFORD COUNTY

Atlantic Oil Prod. Co.'s No. 1 Willinger, C NE NE Sec. 18-23-11w	Spudding.

Possible Extension of the Tomball Field Is Seen; Further Increase of Drilling at Hull Dome

By W. A. SPINNEY
Gulf Coast Bureau, The Oil and Gas Journal

HOUSTON, Tex., Oct. 23.—Possible extension of production of the Tomball Field, approximately 7,600 feet northwestward across the Harris County line into southern Montgomery County was indicated late in the week by Stanolind Oil & Gas Co. and Amerada Petroleum Corp.'s No. 1 Theis, J. H. Edwards Survey. This test, which has been reported as running higher than wells in the field proper, has a sand and shale showing oil and gas at a total depth of 5,546 feet. The bottom 8 feet is saturated sand. A string of 7-inch casing was cemented at 5,530 feet and now preparations are being made to test.

A number of other wildcats have been drilled on the Montgomery County side of the Tomball district within the past year but all these have been unsuccessful. The Stanolind well revives some interest in the district, which has proved out disappointing to date, even in the field itself where very little oil sand is found above the water level. The field, however, has spread out over a considerable area.

Just northwest of the Field, Humble Oil & Refining Co.'s No. 2 Bloecher, C. Goodrich Survey, found the sand below the water at 5,599-5,616 feet and at latest report was drilling deeper at 6,050 feet. This test is between the field and the Stanolind test showing oil.

Texas Co. got some small production in its No. 1 H. Martens, C. Goodrich Survey, which was completed for 40 bbls. daily through a quarter-inch choke from sand at 5,552-76 feet. The latter company is starting two new tests, these being No. 1 Hirsch, a half mile north of the nearest producer (Continental Oil Co.'s No. 1 Petrick), and the other a half mile north of the Texas Co.'s No. 1 Bloecher, a north end well. Amerada Petroleum Corp. and Stanolind Oil & Gas Co. are starting a test on their Fletcher tract offsetting to the south the Texas Co.'s Hirsch test.

At Hull

Further increase in drilling activity was shown at Hull, Liberty County, where an intensive play is under way in proving up the Jackson sands flanking the dome on the south side. A total of 13 rigs now are running at Hull, most of these being in the new area on the south.

Miramar Oil Corp. has completed another producer on its 25-acre lease on the present east end of the play. This well, its No. 3 Phoenix, drilled through the Jackson to the Yegua for a test of that horizon but found water and plugged back to approximately 4,600 feet in the Jackson where it made around 300 bbls. daily. This company also is completing its No. 4 Phoenix and is rigging up for No. 5. Mecom and McAlister and associates also have started drilling on a small strip 32 feet wide located between the Miramar lease and Humble Oil & Refining Co.'s Hooks-Guedry tract. The Mecom well, No. 1 Barrows, is a direct offset to Miramar's No. 4 Phoenix. The Barrows test is being offset to the west by Humble's No. 27 Hooks-Guedry, the second well to be drilled by the latter company in the new play.

Among the new tests starting up on the south side of Hull is Yount Lee Oil Co.'s No. 1 Hooks-Sterling, about 1,000 feet westward around the dome and about midway between the new Jackson production on the southeast side and the older Jackson production on the southwest side of the dome.

Livingston Field

Production in the Livingston Field, Polk County, may be extended to the southwest by the completion of the B. & W. Oil Co.'s No. 1 J. M. West, which has set the 7-inch casing at 4,329 feet after failing in an attempt to take a drill stem test of a showing of oil found from 4,330-59 feet. This test is about a half mile southwest from Skelly Oil Co.'s No. 1 Sanders. The latter, which made a gas well with some oil at 4,315 feet and which blew wild for a short time, has been drilled deeper to 4,322 feet. This test also extends production in the Livingston area about a half mile to the southwest.

Humble Oil & Refining Co.'s No. 1 Grandbury, the west offset to the Skelly well, was drilling in sand at 4,320 feet, the last part of the week.

Dick Schwab's No. 1 Kirby & West, a wildcat in Polk County, is fishing for a joint of casing and part of a core barrel. Attempts were made during the week to core deeper after the 7-inch casing had been run but it was impossible to do much against the bottom hole pressure. A test made of the well's pressure showed that in four minutes the gauge registered a pressure of 650 pounds and within eight minutes it increased to around 800 pounds. The drill pipe was stuck early in the week and little progress has been made at the test toward its completion. It is estimated that the well will make at least 40,000,000 to 50,000,000 feet of gas a day.

It has been reported several times that the test nearly got out of control due to its high pressure. The showing was found in the Cockfield sand 4,711-71 feet, and a sand core at 4,740 feet showed a saturation of oil.

This latest finding of oil and gas in wildcat territory is located on a block of about 1,850 acres at the junction of a number of surveys, among them being the Thomas, Sublet, the I.&G.N., and the Irion. The test is located between the towns of Ace and Rye and about equal distance from each. Trading in royalties and leases has been brisk in the surrounding territory since the test found the Hockleyensis high.

Victoria County

In the Coleta Field, Victoria County, Stoneleigh Oil & Gas Co.'s No. 1 Zimmer, at latest report, was drilling at 3,823 feet. The operators are expecting to reach a gas showing sand found in the discovery well at 3,983 feet, within the next 50 feet. No. 1 Zimmer is believed to be running about 100 feet higher than the discovery well, No. 1 Terrell. The latter passed up the gas sand at 3,983 feet and drilled to sand at 4,417-37 feet in which it was completed as a gas well with 1,500 pounds pressure. No. 1 Zimmer will be drilled to this horizon unless oil and gas is found in shallower sands.

Leon County

The Leon County wildcat test of Shell Petroleum Corp., No. 1 Beggs, in the John Carter Survey, found a showing of oil and gas in sand at 5,723 feet. A string of 7-inch casing was cemented at 5,685 feet. The cement plug has been drilled out and the hole is being cored deeper.

Greta

Four wells were completed during the week at Greta, Refugio County. From the present indications the wells along the extreme west edge of the field are showing only a small amount of gas and it is possible the producing area in that direction is being defined. Operators held a meeting at Refugio Courthouse on Saturday afternoon to discuss the best way to develop the deep 5,900-foot pay horizon in the Greta Field. At this time there is only one well producing from this horizon. One other test is drilling to this sand, this being Nesral Oil Co.'s No. 1 Ira Heard, which was below 5,600 feet on the last reports. Some have expressed the opinion that this 5,900-foot pay sand is the Frio and will be found only on the east edges of the field. Little is known about this horizon at Greta and the operators expect to get a higher allowable for wells from it for the time being.

United Production Co.'s No. 6 Fox Estate, on the extreme west edge of the field, failed to flow naturally and has been put on a gas lift by which it made initially 100 bbls. daily from the regular Greta sand at 4,362-90 feet. This well extends production a half mile to the west, but it also is the first indication of playing out of the field in that direction. The same company's No. 8 Fox Estate, a half mile south and east of nearest production, is showing oil and water in broken sand at 4,390-4,403 feet. The completion of this will be an important marker of trends in that direction.

Floboots Oil Corp.'s No. 1-B O'Brien, J. H. Peoples Survey, was completed during the week making 200 bbls. of pipe line oil through a one-sixteenth inch choke from sand at a total depth of 4,398 feet. This is the most easterly producer in the field producing from the regular Greta sand. Nesral Oil Co.'s No. 2 Heard is located farther east but is producing from the deep Frio sand at 5,900 feet.

In the south end of the Greta Field Nesral Oil Co.'s No. 2 O'Connor, N. S. Crunk Survey, was completed for 220 bbls. of oil and considerable gas a day. The gas had a pressure of 1,550 pounds.

A couple of outpost tests have started up drilling. They are the Hewitt and Daugherty's No. 1 Lambert, about a half mile south of the nearest other production, and Humble Oil & Refining Co.'s No. 1 Heard, in the M. J. Ximenes Survey, it being the most southeasterly test drilling in the field. It is a half mile south and a half mile east from the nearest other producer.

Refugio County

Texas Co.'s No. 1 Rooke, in J. M. Aldrette Survey, a wildcat test in the Bonnie View district, Refugio County, was drilling in broken sand and shale at 4,605 feet on the last reports. This is considered an important test. It is expected this test will be drilled to a total depth of 6,000 feet before being abandoned.

Louise Area

The week found little change in the tests drilling in the Louise area, Wharton County. Pure Oil Co.'s No. 1 Stewart has set a whipstock at 5,404 feet and is preparing to drill a new hole to retest the oil showing found in a 6,000-foot sand in the original test. Pure Oil Co.'s No. 1 Landcaster is drilling at 5,588 feet; No. 1 W. McIntyre, 660 feet southeast of the Stewart No. 1, is drilling at 5,155 feet; No. 1 W. Houston, Section 28, is at 5,519 feet; while No. 1 Wilder, Section 28, is drilling at 6,302 feet. All of the other tests are temporarily shut down, with the exception of the Pure Oil Co.'s No. 1 Kuntze, which is fishing. The total depth of this test is 7,134 feet in oil sand found from 7,128-34 feet.

Gulf Coast Fields and Wildcats

Week Ending October 21

DAMON MOUND—BRAZORIA COUNTY

Company, farm and location—	Remarks
Intercoastal Oil Co.'s No. 11 Wisdom, 350 ft. E of No. 6, Blk. 51, Lot D, A. Durst Sur.	T.D. 3,160 ft.; D.S. stuck at 2,127 ft.; fishing.

MANVEL—BRAZORIA COUNTY

Texas Co.'s No. 3-B Belcher, 2,747 ft. NE, 1,478 ft. SE of W center of lease	Drlg. shale and lime 3,923 ft.
Texas Co.'s No. 5-A Belcher, S 40 deg. W 3,430 ft., S 48 deg. E 300 ft. from N cor. of "A" lease, H. N. Little Sur.	Drlg. sand 5,644 ft.
Texas Co.'s No. 6 Belcher, H. N. Little Sur., South 42° W 2,400 ft. and S 48° E 400 ft. from N cor. lease	T.D. 5,476 ft.; standing.
The Texas Co.'s No. 2 Davis, 300 ft. out of S cor. Lot 42, H. N. Little Sur.	T.D. 5,812 ft.; standing.
Texas Co.'s No. 1 Ellis, 1,660 ft. N. 807 ft. S, from NW cor. of lease, H. N. Little Sur.	Drlg. sandy shale 3,966 ft.

STRATTON RIDGE—BRAZORIA COUNTY

Amerada Pet. Corp.'s No. 3 Seaborn (W.O.), Austin & Williams Sur., 1,250 ft. E of W line, 4,550 ft. S of N line	T.D. 5,580 ft. in salt; P.B. to 4,350 ft.; drlg. new hole 4,500 ft.

BARBERS HILL—CHAMBERS COUNTY

Mills Bennett Prod. Co.'s No. 5 Fisher, Wm. Bloodgood Sur., 75 ft. N line, 191 ft. W of No. 4	T.D. 4,407 ft.; sidetracked 4,239 ft.
Mills Bennett Prod. Co.'s No. 3-E Gulf fee, 442 ft. W along S line, 710 ft. N at right angles to S line	Drlg. sandy lime 2,241 ft.
Mills Bennett Prod. Co.'s No. 1-D Barber, 75 ft. S. 65 ft. W of NE cor.	Drlg. cap rock 1,191 ft.
Humble O. & R. Co.'s No. 3-C Kirby, H. Griffith Sur., 311 ft. from SE line, 659 ft. NE line of lease	Drlg. cap rock 1,182 ft.
Sinclair Prairie Oil Co.'s No. 14 Wilburn (W.O.)	T.D. 3,661 ft.; sidetracked 2,650 ft.; drlg. new hole in shale 3,598 ft.
Sinclair Prairie Oil Co.'s No. 15 Wilburn, Henry Griffith League, 150 ft. W of No. 14	Derrick.
Sinclair Prairie Oil Co.'s No. 16 Wilburn, 50 ft. N and 50 ft. W of No. 13	Drlg. salt 1,840 ft.
Sun Oil Co.'s No. 11 J. Wilburn (W.O.), Wm. Hodges Sur.	Drlg. shale 5,500 ft.
Sun Oil Co.'s No. 14 J. Wilburn, Henry Hodges Sur. (W.O.)	T.D. 4,857 ft.; R.U. up to deepen.
Sun Oil Co.'s No. 16 J. Wilburn, Henry Griffith Sur. (W.O.)	T.D. 3,760 ft.; rigging to W.O.

(Continued on Page 130)

Another Good Well Is Found in Cuevitas Pool; Continued Activity in Duval and McMullen

By B. D. STEVENSON
Staff Correspondent, Southwest Texas Fields

SAN ANTONIO, Tex., Oct. 23.—Sun Oil Co. got another good well in the Cuevitas Pool in northwestern Starr County last week, No. 5-A Cuerra, farthest northeast test, coming in gauging 32 bbls. hourly on choke, in sand at 2,257-67 feet. No. 4-A Guerra, due south of it, was a well of the same size. No. 2-A is smaller and No. 1-A, the discovery well, a gas well making 360 bbls. daily and No. 1-C a gas well. The five producers occupy an area little over a half mile square but the company has made a number of other locations that may soon prove more extent to the field and both McGinley and Edgington have derricks up 2 and 3 miles southeast, and Mims and others of Laredo are getting ready to drill southwest.

This development around the new Sun Pool, some new activity around the Jeffries-Lambeth discovery gas well, northeast of Rio Grande City, and continued activity in northern Duval County and southern McMullen County, constitute the leading features of Southwest Texas development at this time.

Two completions drilled since the Jeffries-Lambeth gas well came in in Starr County opening a new field 9 miles northeast of Rio Grande City, have been dry but both of them have been a mile or more from the discovery gas well. Meyers, Jenkins and others are drilling south and the past week Shankle made another location south of the discovery gas well on Starr County Cattle Co. land, 330 feet south of the Jeffries-Lambeth block and 330 feet from the west line of Porcion No. 89.

Jeffries-Lambeth have sold the gas from their well producing from sand at 2,450-55 feet to the Rio Grande City Public Service Co. and a line will be laid into Rio Grande City where the gas will be consumed. The city has been getting its gas supply from shallow wells in the Los Olmos Pool.

Duval County

Navarro Oil Co., Magnolia Petroleum Co., Humble Oil & Refining Co. and Sun Oil Co. are gradually filling out the north end of the North Government Wells Pool. Navarro is drilling four tests at a time and has a total of eight more to finish out the entire west half of Survey No. 360. Sun Oil Co. is offsetting Navarro on the west with a row of wells in Survey No. 359. Humble in the east half of Survey No. 360 has made four locations completing the west half of the east half of Survey 360 and Magnolia the past week completed No. 2 Duval County Ranch Co. in Survey 208 on the north for 20 bbls. hourly and made location for No. 3 to be 660 feet west of No. 1. Navarro Oil Co. is completing its No. 11 Hahl, 330 feet from the north and west lines of the west half of Survey 360, and with the completion of that test the north end of the field will be a half mile wide and due for some further extensions. Any north extensions will be made by the Magnolia.

Several operators in the North Government Wells Pool are showing a disposition lately to fill out their lease blocks by drilling the remaining available inside locations. At the south end of the field, however, where there is a lot of proven but undrilled acreage there is little activity.

Pipe Line to New Well

Humble Pipe Line Co. began laying an extension line from the North Government Wells Pool north 4 miles to Al Buchanan's No. 1 Duval Ranch Co., in Survey 206 that came in a week ago and the line was to have been completed and ready to connect the first of this week. This new field is one of the interesting spots in Southwest Texas as it is the first important production in the Cole sand and thus adds not only a new pool but a new sand as one of the possibilities in the wildcatting in that district. The new pool has been named the Eagle Hill Pool.

Among the wildcats playing the Government Wells trend there were no developments the past week outside of making hole excepting that Paul C. Teas' No. 1 Hagist in Survey No. 181 in southern McMullen County failed to get any Government Wells sand and at 1,700 feet was looking for the Mirando sand.

One new wildcat is soon to enter the field. John Armstrong is arranging to drill No. 1 Kate Martin and location will probably be about the center of H.T.&B.R.R. Survey No. 9 in about the center of the southwest quarter of McMullen County. This location will line up with the trend of the Moca Pool, in Webb County.

Another big lease deal is rumored in Southwest Texas, Humble being reported to have leased the 96,000-acre Yturri ranch in western Hidalgo County. The deal has not been confirmed.

Nueces County

Southwest Oil Co. and Hurlbut's No. 1 Poenisch in Nueces County, 8 miles south of Corpus Christi, has had some little showings of oil at 1,971 feet, 2,093 feet and again at 2,300 feet; also Banquette Oil Co.'s No. 1 Ingram, east of the Agua Dulce Field, had a showing at 2,831 feet, and Texon Royalty Co.'s No. 1 McCoy, 6 miles southeast of Agua Dulce, a showing at 3,180 feet. Nueces County is coming to the front again with activity and Houston Oil Co. has completed No. 4 McGregor in the Saxet Field for 600 bbls. of fluid, half of it oil and the other half salt water in sand at 4,685 feet.

Balcones Fault Zone

Previously announced Edwards lime tests along the Balcones fault are all getting started now and for some weeks this territory that has been somewhat out of the mind of the industry is due to get back in. Walton & Weinert's No. 1 Sorrell in the southwest corner of Guadalupe County is one of the first of the new list of wildcats to get down. At 2,315 feet it was in the Taylor not having topped the chalk yet and already there are some speculations that it may be low. It is on acreage secured from Sinclair Prairie Oil Co. Two others are drilling, Barnhill's No. 1 Phullman, east of Seguin and west of the Sal-Mar discovery well, and O. W. Killam in Green DeWitt Survey No. 13 on land held in fee. Neither had made much hole up to the close of the week.

C. J. Webster will probably skid his rig on No. 1 Fulps and drill another hole. The bit was deflected, some estimate at least one location from the perpendicular in No. 1 and so it did not test the location the geologist picked. It may be plugged back and an attempt made to make a well in the Austin chalk where it had a showing. This test is east of No. 1 McCrory that made a well in a crevice and is southwest of the Dale Field and northeast of the Luling Field and on the same general fault line.

Williamson County

Some new operators have entered the field in Williamson County 8 miles southeast of Taylor where Fritz Fuch's No. 1 Zeischang was completed recently for 10 bbls. daily in Serpentine, opening a new pool. Taylor Production Co. completed No. 1 Bachmeyer for a small well in the same district but No. 1 Sladek was a failure. R. L. Batts last week made a location for a test for No. 1 Rumel, 150 feet from the east line and 480 feet from the south line of 100-acre tract in the Booth Survey, and J. L. Mauldin made location for his No. 1 Zeischang in the White Survey, 150 feet from the east line and 750 feet from the south line of a 23-acre tract. Taylor Production Co. bought the Fuch well and acreage and will doubtless do additional drilling.

Shallow Pool in Guadalupe

J. A. Harper has started to develop the shallow pool at New Berlin in west ern Guadalupe County. He drilled No. 1 Rosenbrook some months ago and it has been making about 3 bbls. daily on the pump at about 800 feet. Now he is starting No. 2 as a southwest offset to No. 1.

G. G. Mortimer is starting a second test on the Peal ranch in Webb County west of the North Dale Field. His No. 1 was abandoned some months ago. No. 2 is in the southeast corner of the west half of Survey 796 and the contract has been let for the test.

Trinity Drillers are getting ready to start a test on the Seeligson land in southern Jim Wells County, the location being in the northeast corner of Survey No. 71 on a 1,000-acre lease just west of the Seeligson block of Magnolia Petroleum Co. on which Magnolia early in the year completed No. 2 Seeligson for a small well.

There has been no subsequent drilling in that territory.

Wildcat Operations in Southwest Texas

Week Ending October 21

ATASCOSA COUNTY

Company, well, farm name, section and block—	Remarks
A. Blume's No. 1 Shaw, 690 ft. from N line, 1,780 ft. from E line of 100-ac. tract in W. Farquhar Sur. No. 275	T.D. 1,996 ft.; reinstated; to resume drlg.
E. O. Burton's No. 1 Blankenship, 1,470 ft. from NW line, 1,830 ft. from SW line of 320-ac. tract, in T. Orr Sur. No. 176	Moving in rig.
J. V. Polk's No. 1 Karnes City Natl. Bank, 2,300 ft. from SW and SE lines of B.S.&F. No. 5	T.D. 940 ft.; abd. dry.

BASTROP COUNTY

Cole Pet. Co.'s No. 1 Cole, 150 ft. from S and E lines of 700-ac. tract, Blk. 30, in R. Gage Sur. No. 10	T.D. 125 ft.; drlg.
J. E. Emanuel's No. 1 H. Klemm, 617 ft. from W line, 300 ft. from S line of tract in R. S. Teal Sur.	T.D. 850 ft.; abd.
Ca-Tex O. & G. Dev. Corp.'s No. 1 Pendergrass, 1,348 ft. from NE, 310 ft. from SE line of 130-ac. tract in Henry Warnell Sur.	Rigged up and S.D.
Three Oil Co.'s No. 1 M. Ingram, 1,250 ft. from SW line, 940 ft. from SE line of tract in M. Morgan Sur.	Rigged up.

BEE COUNTY

Grisham et al's No. 1 Powell, 900 ft. N, 500 ft. W of SE cor. of J. A. Reed Sur.	Drlg. wtr. well.
Holland Oil Co.'s No. 1 Copeland, NE cor. of 400-ac. tract in Pace Sur.	T.D. 3,930 ft.; drlg.
W. P. McLain's No. 1 Weiss, 400 ft. E of line between E. S. Price's Nos. 1 and 2 Weiss	T.D. 4,000 ft.; coring.

BELL COUNTY

Gus Winston et al's No. 3 Warrick, 100 ft. N of James Scoggins' No. 1 Warrick, in Elijah Ingram Sur.	T.D. 1,590 ft.; drlg.
R. S. Wilson's No. 1 Davenport, 300 ft. from W line, 700 ft. from S line of J. L. Herred Sur.	T.D. 1,235 ft.; standing.

BEXAR COUNTY

C. I. Albertson's No. 2 C. Hoke estate, 675 ft. from E line, 250 ft. N of Medina River in Jose Maria Barrera Sur.	T.D. 570 ft.; drlg. shale.
F. J. Von Dolden et al's No. 1 Frank Webber, 150 acres in J. Montez No. 6	T.D. 100 ft.; standing.
Austin Hull's No. 1 Clemon, 360 ft. from W line, 2,500 ft. from S line of tract, 12 miles N of San Antonio	T.D. 1,810 ft.; standing.
LaSalle Oil Co.'s No. 1 City Sewage farm, 150 ft. S of Rilling Road, 450 ft. W of NE cor. of tract in D. Bustillos Sur.	T.D. 75 ft.; standing.
Motes-Campbell's No. 2 Stumberg, 450 ft. from N line, 450 ft. from W line of S. Stumberg 140-ac. tract in F. Rolen Sur. No. 48	T.D. 597 ft.; drlg.
George L. O'Neill's No. 1 Neimann in Juan Montez Sur. No. 6	T.D. 725 ft.; drlg.
Fred Perrenot's No. 1 Ruiz, SE cor. of 82-ac. tract in F. Rowland (Rolen) Sur. No. 48	T.D. 819 ft.; standing.
Fred A. Perrenot's No. 1 Russell, 750 varas from NE line, 64 varas from NW line of 500-ac. tract in Rodriguez Sur.	T.D. 1,315 ft.; standing.
H. A. Pagenkopf's No. 1 G. A. Goeth, 500 ft. from SE line, 600 ft. from SW line which is San Antonio River, Juan Montes Sur.	T.D. 2,010 ft.; hole clear; standing.
Earl A. Post's No. 8 J. F. and F. X. Bilhartz, 150 ft. from N and E lines of S 200 acres of 385-ac. tract in F. Boles Sur.	Moving in rig.
C. A. Smith's No. 1 Henry Lamb, 750 ft. from N and E lines of Lamb farm, in de la Garza grant	T.D. 620 ft.; drlg.
F. E. Togier's No. 1 Brackenridge, 575 ft. from S line, 1,284 ft. from W line of tract in Maria Gertrudis de Alanis Sur.	T.D. 1,330 ft. in chalk showing oil; reaming.

BLANCO COUNTY

Blanco Development Co.'s (McGee) No. 1 A. J. Dittmar, 1,320 ft. from S line, 150 ft. from W line of George Evans Sur. No. 58, 4 miles NW of Johnson City	T.D. 720 ft.; standing.

(Continued on Page 132)

Geophysical Block in Webster Parish Holding Interest in North Louisiana Development

SHREVEPORT, La., Oct. 23.—Aside from intense interest in one or two wildcat tests, this division developed nothing of interest during the past seven-day period. Only five completions were reported, consisting of one small producer and four dry holes, but activity in the several districts continues to show strength with 16 new locations staked, 14 in North Louisiana and two in South Arkansas.

The Gulf Refining Co.'s geophysical block in Webster Parish continues to hold most interest and promises to be the hot wildcat spot for several weeks as the operators have started a series of core tests with a gasoline rig capable of making 4,500 to 5,000 feet, which ordinarily in this district would contact the upper stratums of the lower cretaceous formations. Gulf's test is in the northwest corner of Section 20-19-8, on a geophysical high after running a torsion balance and seismographic survey. This immediate area was mapped out as a surface structural high in 1919 after the discovery of the Homer Field in Claiborne Parish, about 12 miles to the northeast. The most thorough test that has been drilled to date in the vicinity of this block was Hope Oil Co.'s No. 1 Matt Moore, Section 13-19-9, about 2 miles northwest of the present core test. This well was started by that company in June, 1919, and drilled to 1,400 feet. It was abandoned at this depth but in October, 1922, was taken over by John Y. Snyder and drilled to 3,012 feet. From 1,400 feet to the total depth, the log of this well shows a variation of formations not to be found in any other test drilled in the North Louisiana district. A cavity was penetrated around 2,600 feet into which large quantities of mud, sawdust and other materials were pumped before drilling proceeded, and the test as abandoned at 3,012 feet stands as the lowest well, geologically, ever drilled in this district.

NORTH LOUISIANA

Of the 14 new locations in North Louisiana, only three were rank wildcats, the others being in the Converse and Zwolle Fields of Sabine Parish. In Bossier Parish, McKinney & Stewart have staked No. 1 Nattin in Section 22-22-14. The test is 6 miles west of Plain Dealing in the Miller Bluff area where several tests have been drilled with good oil showings, one of the wells pumping about 12 bbls. daily of 30.5 gravity oil. Gulf Refining Co. has a block of about 10,000 acres in this area on which a seismographic survey has been made. J. P. Evans' No. 1 Claude Burson, Section 27-18-9, south of the town of Sibley in Webster Parish, is moving in rig. This wildcat is on a magnetometer high northeast of the Lake Bisteneau salt dome area. In DeSoto Parish, Hirschfeld & Baily have derrick up on their No. 1 C. S. Youngblood in Section 9-11-14.

Other North Louisiana drilling operations follow: H. I. Morgan's No. 2 Smith, a lower Trinity test in Section 22-19-11, 2 miles south of the Bellevue shallow field in Bossier Parish, is drilling at 6,125 feet. About 5 miles northwest, B. A. Sherrell's No. 1 fee, Section 18-19-11, after recementing 6-inch casing, tested about 1,000,000 feet of gas and an estimated 5,000 bbls. of salt water from the same total depth of 2,207 feet. The well bridged over and went dead, and the operators are running a string of tubing in an effort to make a commercial gas well. United Gas Public Service Co.'s No. 3 Skannall, Section 14-17-12, in the Sligo gas district of southern Bossier Parish, cored sand from 2,459-68 feet and 6⅝-inch casing is being set at 2,415 feet. In Jackson Parish, 7 miles east of Jonesboro, A. C. Thomas' No. 1 Johns, Section 25-15-3, cored sandy shale at 2,050 feet with a show of gas and oil and a drill stem test will be made at this depth. One new operation is slated in Natchitoches Parish with a derrick up on George R. Stevens' No. 1 Clarke in Section 10-5n-6w. Five wells in the Zwolle and Converse Fields of Sabine Parish are testing and should report some producers from some of them.

Zwolle Producer

The one producer was from the western part of the Zwolle Field. Rotary Oil Corp.'s No. 1 Hale, Section 1-7-13, was completed pumping and flowing 100 bbls. daily from 2,440 feet. The other three were dusters from as many parishes. In DeSoto Parish, J. H. McKenzie's No. 2 B. F. Jenkins, Section 35-15-12, was dry and abandoned at 2,465 feet. A Grant Parish test, Guy Cox and others' No. 1 Lewis, Section 8-6-1e, was abandoned as dry at 2,525 feet. The log on this test gave the top of the Cockfield at 1,163 feet with the base of the Sparta at 2,315 feet. H. W. Perritt and C. H. Lyons' No. 1 Stovall, Section 2-22-9, Webster Parish, encountered salt water and was abandoned at 2,778 feet. Sandy shale was cored from 2,750-60 feet and from 276-70 feet which had a show of gas. This wildcat is about 6 miles east of the old Gleason wells, one of which cratered and ran wild for months in the Shongaloo gas district.

ARKANSAS

South Arkansas reported one completion, a dry hole, and another test to offset it. George W. Harper's No. 1 Bodcaw, Section 15-15-22, Lafayette County, was abandoned at 2,417 feet after several shows and drill stem tests from 2,040 feet to the total depth. The same operator has skidded over 600 feet and after setting 10-inch surface casing at 104 feet contacted the top of the Nacatoch at 1,193 feet. Sand was cored from this depth to 1,201 feet and 8-inch casing was set at 1,190 feet for a test with the bottom of the hole at 1,198 feet.

In Columbia County, O. F. Whittaker has derrick up on his No. 1 Garney in Section 11-15-20, and C. W. Alworth is temporarily shut down on his No. 1 King, Section 16-17-20, at 1,879 feet. The latter test cored salt water sand from 1,876 feet to the total depth. A new rig is moving into Jefferson County, J. E. Elliott's No. 1 Nevin, Section 27-4-10. In the Miller County area Duluth-Arkansas Oil Co. is arranging to set casing on its No. 2 Beck, Section 34-15-26, after coring oil sand from 2,812-18 feet. Gleason-Wendell Drilling Co. is arranging to deepen its No. 1 Patterson, Section 5-19-28, from the total depth of 2,912 feet. In the proven area of Ouachita County, J. D. Reynolds' No. 1 Snow Hill Baptist Church, Section 28-15-15, is waiting on standard rig to pump after coring oil sand from 1,960-65 feet. E. R. Henderson's No. 1 J. H. Ogden, Section 32-18-14, Union County, tested dry with a show of oil at 2,183 feet. A likely looking sand was cored in this test from 2,168-79 feet and casing was set at 2,165 feet for a test. In the same county, Charles Steele is rigging up on his No. 1 J. B. Combs in Section 25-18-16.

Wildcat Operations in Louisiana-Arkansas

(Rotary operations unless otherwise designated)

North Louisiana

BIENVILLE PARISH

Company, well, farm name, section and block—	Remarks:
Poole & Johnson's No. 1 H. E. Sudduth, 1,170 ft. E and S, C Sec. 28-14-16	Derrick.

BOSSIER PARISH

B. A. Sherrell, tr.'s No. 1 fee, NE NW NW Sec. 18-19-11	Tested 1,000,000 ft. gas, 5,000 bbls. salt wtr. 2,207 ft.

CADDO PARISH

R. E. Davidson et al's No. 1 DeWitsey MacMillan, 500 ft. N, 330 ft. E, SW cor. Lot 16, Sec. 23-16-13	Set 10-in. 100 ft.; drlg. 884 ft.
J. B. Hutchinson, tr.'s No. 1 Story Phillips, 330 ft. N and E, SW cor. SW NE SE Sec. 32-16-12	S.D. 2,200 ft.

CALDWELL PARISH

Hartley et al's No. 1 Taylor, most southeasterly cor. Sec. 42-14-4e	Derrick.

CATAHOULA PARISH

George Greer et al's No. 1 Millsap, 250 ft. S and E NW cor. Sec. 22-10n-7e	Location.

DE SOTO PARISH

Bailey Gants et al's No. 1 Jenkins, NW cor. SE SW Sec. 35-15-12	Moving in heavy rig; T.D. 3,090 ft.
J. H. McKenzie's (was P. B. Dyer's) No. 2 B. F. Jenkins, 330 ft. N and E, SW cor. NW SW Sec. 35-15-12	Dry and abnd. 2,465 ft.
Hirschfield-Bailey Interests' No. 1 Mickle, 660 ft. N and E, SW cor. SE Sec. 7-13-13	Waiting on csg. 1,775 ft.
N. B. Porter's No. 1 J. W. Porter Est., 330 ft. N and E, SW cor. SE SE Sec. 23-12-13	S.D.; T.D. 1,204 ft.
D. H. Sebastian, Jr.'s No. 1 W. H. Hill et al, 200 ft. S and E, C Sec. 3-10-13	Derrick.

GRANT PARISH

L. L. Lindsey et al's No. 1 Edenborn, 250 ft. E, 150 ft. N, SW cor. SE SE Sec. 13-7-4	S.D. 40 ft. (corrected).

OUACHITA PARISH

Hope Prod. Co.'s No. 1 Cole Hrs., 150 ft. S, 1,650 ft. W from NE cor. of SE	S.D. 881 ft.

SABINE PARISH

Frank R. Foster, Inc.'s No. 1 D. E. Stephens, 320 ft. S and E, NW cor. SE NW Sec. 17-9-11	S.D. for fuel 2,710 ft.

CONVERSE DISTRICT

Arrock Oil Co.'s No. 1 Hewitt, 330 ft. N and E, SW cor. NE SE Sec. 20-9-13	Bailing 1,940 ft.
A. G. Craig's No. 1 Belton, 330 ft. N and E, SW cor. NW NW Sec. 33-9-13	Set 10-in. 40 ft.
Helena O. & G. Co.'s No. 1 E. K. Harris, 990 ft. S and W, C Sec. 10-9-13	Derrick.
Mamie S. Hammond's No. 1 Patrick, 330 ft. N, 330 ft. W, SE cor. Sec. 1-9-13	T.A. 3,235 ft.
R. P. Holland et al's No. 1 A. J. Burkett, 990 ft. N, 330 ft. W of C, Sec. 16-9-13	Set 12-in. 20 ft.
H. C. Lesinger's No. 1 Bowman-Hicks Lbr. Co., 338 ft. S and E, NW cor. SW Sec. 13-9-13	Reaming 3,285 ft.
Joe Modisette's No. 4 Frost Lumber Co., 990 ft. W, 330 ft. from C Sec. 21-9-13	Set 12-in. 62 ft.; drlg. 1,190 ft.
J. E. Sedbury's No. 1 E. K. Harris, 990 ft. W, 330 ft. S, C Sec. 10-9-13	Rigging up.
Wm. Stewart et al's No. 1 Latham, 330 ft. N and E, SW cor. NW NE Sec. 22-9-13	Testing with acid 1,904 ft.
Homer Tyson's No. 1 G. W. Hough, 330 ft. S and E, NW cor. SW NW Sec. 31-9-13	S.D. 40 ft.
Windsor Oil Co.'s No. 2 Barr, 330 ft. N and E, SW cor. NW Sec. 15-9-13	Location.

WEBSTER PARISH

J. P. Evans' No. 1 Burson, 350 ft. N and E SW cor. NW SE Sec. 27-18-9	Derrick.

Arkansas

COLUMBIA COUNTY

C. W. Alworth et al's No. 1 W. D. King, SW cor. SE SW Sec. 16-17-20	Cored S.W. 1,879 ft.; S.D.

JEFFERSON COUNTY

J. E. Elliott's No. 1 B. V. Nevin, 440 ft. N and E, SW cor. SW NW Sec. 26-4-10	Rigging up.

HEMPSTEAD COUNTY

Kentucky O. & G. Co.'s No. 1 Leslie, NW cor. SW NW Sec. 21-9-26	Derrick.

LAFAYETTE COUNTY

George W. Harper's No. 2 Bodcaw, 150 ft. S, 550 ft. E NW cor. SW NW Sec. 16-15-22	Set 10-in. 104 ft.; set 8¾-in. 1,190 ft.

LONOKE COUNTY

Joe D. Strahan's No. 1 Hardin, 300 ft. S and E, NW cor. NW NW Sec. 18-2n-7	Rigged up and W.O.

MILLER COUNTY

Duluth-Ark. Oil Co.'s No. 2 Beck, 330 ft. S and E, NW cor. SE SW Sec. 34-15-26	Arranging to set csg. 2,812 ft.; T.D. 2,818 ft.

OUACHITA COUNTY

F. G. Harrell's No. 1 Poindexter, 330 ft. S and E NW cor. Sec. 35-15-18	Drlg. 100 ft.
J. D. Reynolds' No. 1 Snow Hill Baptist Church, 535 ft. E, 115 ft. S, NW cor. SE NW Sec. 28-15-15	W.O.S.R., 1,960 ft.

(Continued on Page 134)

Daily Average Runs

There was a daily average increase of 165 bbls. in the runs from the fields of North Louisiana and Arkansas during the past week. The former showed a net increase of 150 bbls. daily while the latter gained only 15 bbls. per day over the previous week. The daily average runs from the several pools were:

NORTH LOUISIANA

	Bbls.
Caddo light	4,580
Caddo heavy	1,355
Converse	700
Cotton Valley	470
DeSoto and Red River	1,505
Elm Grove	400
Haynesville	3,840
Holly	205
Homer	2,690
Pleasant Hill	235
Sarepta-Carterville	810
Urania	2,950
Zwolle	6,230
Total North Louisiana	25,970
Total previous week	25,820
Increase	150

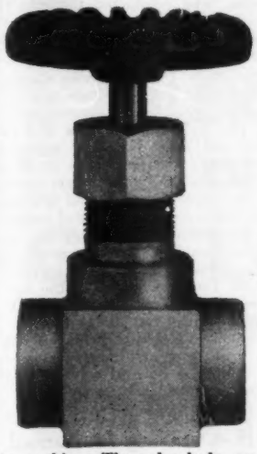
ARKANSAS

Champagnolle	1,230
El Dorado	2,580
Lisbon	415
Miller County	665
Nevada	535
Smackover light	2,650
Smackover heavy	21,250
Stephens	440
Urbana	3,025
Total Arkansas	32,940
Total previous week	32,925
Increase	15
Total both states	58,910
Total previous week	58,745
Increase	165

NEW AND IMPROVED EQUIPMENT

Production Is Started on Needle Valve for Gauges

The Houston Oil Tool Co., 934 Adele Street, Houston, Tex., announces production on a new 10,000-pound test needle valve for gauges. It is made of forged steel, heat-treated, and packed with as-



bestos packing. The valve body, made in a single piece, is furnished in both male and female connections.

The manufacturers have appointed the Oil Center Tool Co., of Houston, exclusive distributors of this gauge valve, and distribution will be made through all leading supply stores, as are all OCT products.

Cutting Tools Designed to Meet Threading Standards

To meet the demand for a higher degree of accuracy in cutting taper threads on pipe and tubing the National Acme Co., Cleveland, Ohio, has produced a complete line of circular chaser receding taps from 4 to 13⅜ inches, and a series of expanding dies also employing circular chasers from 1 to 13⅜ inches.

The need of accurate threads is pronounced in oil field casing work where greater depth of wells has led to greater strain on the pipe joint, and a higher liquid pressure, and where the necessity for economy has led to the repeated use of the tubing. This means that a fine finish is necessary on the threaded surface, permitting repeated use without roughing up the surface.

The fundamental idea of the circular chaser, which resembles a circular forming tool, is to present a large quantity of steel back of the cutting edge, to carry away cutting heat and afford rigid support to the cutting edge. This means that more threads can be cut for each grind of the chaser, and because the entire periphery of the chaser can be used without change in thread form, a great many more grinds are possible before throwing away the remnant of the chaser. The tools are designed for use in any commercial type horizontal or vertical machine.

BROWN ANNOUNCES NEW DEVICE

The new Brown thermometer and pressure gauge, announced by the Brown Instrument Co., Philadelphia, Pa., has new and outstanding features. Among them are these: (1) Electric chart drive is standard; (2) automatic pen release; (3) chart knob eliminated; (4) switch to start and stop chart drive; (5) combination door handle and built-in lock.

Notes About Trade Literature

The C. J. Tagliabue Manufacturing Co., Park and Nostrand Avenues, Brooklyn, N. Y., has prepared a bulletin, sent to those who ask for it, describing the new certified hydrometers which the company has developed.

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The Merco Nordstrom Valve Co., 400 North Lexington Street, Pittsburgh, Pa., subsidiary of the Pittsburgh Equitable Meter Co., has two new bulletins, "Nordstrom Lubricated Plug Valves for Oil and Gas Well Drilling" and "Timken Michigan 'Screw Lift' Plug Valves."

—

The Borden Co., Warren, Ohio, is sending upon request a bulletin describing the Beaver line of pipe tools, including two new ones, the No. 100 tubing cutter and the No. 204 square-built wheel cutter.

—

The October number of the Reading Puddle Ball, published by the Reading Iron Co., Philadelphia, Pa., continues its interesting story of puddled iron. This installment tells of the old African slave trade and the part wrought iron played in it.

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The current issue of the Gardner-Denver News, published by the Gardner-Denver Co., Quincy, Ill., contains an unusual number of timely articles of interest to oil men.

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Two circulars mailed on request by the Wolverine Industries, Harbert, Mich., describe two new tools put on the market by that organization, the Velvo-grip vise and Velvo-grip wrench.

—

The Consolidated Ashcroft Hancock Co., Bridgeport, Conn., is distributing a bulletin announcing the new Ashcroft American gauge, which is described as light in weight, in an acid-proof and moisture-proof case.

—

Two bulletins of interest have been issued by the Oil Well Supply Co., Dallas, Tex. One describes the new Imperial No. 50 oilbath geared power and the other the Oilwell ODH-18 individual pumping power.

—

"Cletrac Facts" is the title of a 12-page bulletin prepared by the Cleveland Tractor Co., 19300 Euclid Avenue, Cleveland, Ohio, discussing a method of installing a secondary road system.

—

A booklet of 12 pages and cover published by the Dearborn Chemical Co., 310 South Michigan Avenue, Chicago, is devoted to Dearborn water-treating units and testing equipment.

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A folder issued by the Ingersoll Steel & Disc Co., division of the Borg-Warner Corp., Chicago, illustrates many applications of IngOclad stainless clad steel. It shows installation views of tanks, pressure vessels, autoclaves, evaporators, etc.

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The Edward Valve & Manufacturing Co., Inc., East Chicago, Ind., has issued Section L of its catalog No. 11 showing its complete line of Ferac (high strength iron) valves, including nonreturn, globe and angle stop, check and blowoff valves.

—

A new price list bulletin issued by Tube-Turns, Inc., 1300 South Shelby Street, Louisville, Ky., contains descriptive information on Tube-Turns, welding flanges, tees, etc. It includes also dimensional and engineering data, making the bulletin a reference and engineering handbook.

Gauger's Job Made Easier By Curtin Centrifuge

The new model hand-driven centrifuges manufactured by W. H. Curtin & Co., Houston, Tex., are designed to enable the gauger to maintain required speed over the necessary period of time with less fatigue. These centrifuges are of the heavy-duty type, simple in design and require no special care.

The gear ratio and the throw of the crank have been designed to produce the required speed with the least effort on the part of the operator consistent with good mechanical construction. The driving gear has a heavy reinforced web equipped with roller thrust bearing and spacing washers to insure proper mesh with the pinion. Both the gear and pinion shafts are bronze bushed and enclosed in oil-tight housings.

The crank clears the trunnion cups in all positions, and disengages from the clutch collar instantly when released, thus reducing wear on the gears and permitting a gradual rather than a sudden slowing of the centrifuge, thereby preventing agitation of the precipitated sediment.

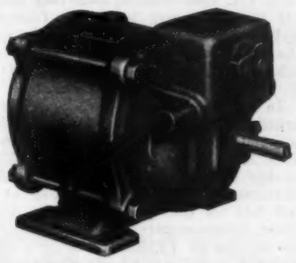
The double-jaw clamping lugs have a serrated gripping surface with reinforced buttresses, which are drilled with countersunk bolt holes to permit permanent mounting.

The clamping screw is equipped with a swinging adjustable lever to facilitate tightening. These centrifuges, according to the manufacturer, meet A.P.I. specifications. The entire machine is finished in gray enamel and easy to keep clean.

Century Introducing Pump Motor for Filling Stations

The Century Electric Co., St. Louis, Mo., announces a line of explosion-proof automobile filling station gasoline pump motors, available in split-phase, repulsion-start single-phase and direct-current types.

The frame is of rolled steel with cast iron end brackets. There are no removable plugs or caps. The bearing brackets are held in place by four holding bolts through holes outside the closure. The switch-shaft and motor-shaft bearing housings are flanged and drained to pre-



vent liquid gasoline from entering the switch closure along the switch shaft or the oil well along the motor shaft. The bearings are phosphor bronze with the Century wool yarn system of lubrication.

The switch, actuated from the nozzle-hook, is a double pole circuit-breaker provided with thermal overload protection that trips free and cannot be held closed under sustained overload. The overload is reset from the nozzle-hook. The switch is completely enclosed inside the solid cast iron end bracket. The terminals are brought out through a pipe nipple and sealed with a compound unaffected by gasoline.

IMPROVED HANDY FLOODLIGHTS

Improvements in its line of handy floodlights have been announced by the General Electric Co. In its exposition model, designed originally for the Century of Progress show in Chicago, an adjustable socket support is now being provided to accommodate both 500 and 1,000-watt general service incandescent lamps. When the socket is fully in, the 1,000-watt lamp is in focus. When the socket is fully out, the 500-watt lamp is in focus. A 1,500-watt hard glass lamp can be used with the projector, provided the lens is removed. Other changes include a slightly increased gauge of the aluminum casing, and the use of a substantial hexagonal nut to give positive clamping to the standard mounting.

PORTABLE CUTTING MACHINE

A portable cutting machine weighing only 43 pounds has been announced by the Linde Air Products Co., 30 East Forty-second Street, New York, as an addition to its Oxweld line of apparatus. It is known as the Secator. Combining the portability of a blowpipe with the accuracy and finish of a cutting machine, the Secator makes it possible to do high-quality cutting anywhere in the shop or in the field. It should be especially valuable to plate shops, tank builders, steel plants, etc. Essentially it consists of an Oxweld Type C-14-H blowpipe (especially designed for it) mounted on an electrically driven, air-cooled, dustproof chassis. It is equipped with a direct drive and runs either on a 1½-inch angle-iron track, furnished with it, or on any relatively smooth plate.

NATURAL GAS DEVELOPMENTS

Northern Pennsylvania and New York Gas Tests

WELLSBORO, Pa., Oct. 21.—In the Potter County Field, with the exception of the following, all wells have temporarily shut down: Tioga Natural Gas Co.'s test on the property of the First National Bank of Emporium in Shippen Township, drilling at 4,175 feet; Hanley and Bird, drilling at 4,095 feet on the S. Gooch, Hebron, where at 1,200 feet they got 450,000 feet of gas; East Penn Development Co., drilling at 1,300 feet on the Emporium Lumber Co.'s tract in the East Fork district; Potter Development Co., moving in on the Gray Chemical Co.'s property in Clara Township. Sylvania Corp. reports a new location on the J. Higley, Hebron and Barker and others maintain their location on the U. B. Russell, Genesee Township.

In New York State, Mid-East Corp. is drilling at 2,070 feet on the M. Reubenstein, Bristol Township, Ontario County; J. B. Reed interests drilling at 2,000 feet on the Roder-Scott, Allegany Township, Cattaraugus County and drilling at 4,085 feet on the Quinlan Oil Co. tract, Olean, same county; Hanley and Bird are drilling at 1,210 feet on the Charles Noble, Galen Township, Wayne County; Tom Boise drilling at 1,520 feet on the No. 2 Harper property, Galen Township, Wayne County; Peterman and others drilling at 420 feet on the W. H. Clapper, Waterloo, Seneca County; Carpenter and others are shut down at 1,700 feet on the A. M. Houseworth, Hector Township, Schuyler County; Property Shares, Inc., are building a rig on the Charles Vanderbilt, Galen Township, Wayne County; Glen Dearth and others are drilling at 590 feet on the Fred Dadson, Julius Township, Seneca County; Gas States Corp. is spudding on the Walter Eichorn, Dansville, Steuben County; Geneva Natural Gas Co. is drilling at 110 feet on the G. W. Decker, Phelps Township, Ontario County; E. A. Adams and others are moving in on the H. Weckerlin, Julius Township, Seneca County.

New York Banker Named New O. N. G. Treasurer

John Mitchell, New York, vice president of the Central Hanover Bank & Trust Co., has been elected as treasurer of the Oklahoma Natural Gas Corp.

The resignation of W. K. Cottrell had been accepted. A. E. Bradshaw, the corporation's new president, said a general reorganization of the personnel will be made. Resignations have been submitted by Reid McBeth, director of public relations, and George Goodale, Tulsa, and Eugene Kerr, Muskogee, assistants.

CANADIAN PRODUCTION

OTTAWA, Ontario, Oct. 23.—The output of natural gas from all Canadian fields in August amounted to 945,161,000 feet compared with 1,002,429,000 feet in July and 888 925,000 feet in August, 1932. During the first eight months of 1933, the total Canadian production was 15,260 802,000 feet compared with 19,926 909,000 feet in the same period of 1932.

Imports of mixed (natural and artificial) gas into Canada in August totaled 8,123.000 feet worth $5,750, against 9,249,000 feet worth $6,734 in July.

NEW COFFEYVILLE LINE

The Nowata Pipe & Supply Co. has completed a 6¼-inch gas line for the Trinity Gas Co. of Tulsa. There were 10 miles of line, from Coffeyville, Kans., 10 miles southwest into Oklahoma.

Three-Judge U.S. Court Sustains Appeal of Pipe Line Company in Mississippi

A decision of wide interest to the natural gas industry is that rendered by a three-judge Federal Court in Mississippi in the case of the Interstate Natural Gas Co., Inc., against the state tax collector who sought to assess the company's real and personal property for ad valorem taxes in 1927-1931.

The court was composed of Circuit Judge Rufus E. Foster, New Orleans, La., and District Judges Edwin R. Holmes, Jackson, Miss., and Allen Cox, Aberdeen, Miss. The Interstate company was represented by its counsel, David C. Bramlette of Woodville, Miss.

The court held that the exemption claimed by the company should not be denied merely because it is a foreign corporation, and continued:

"It is next contended that the plaintiff is not 'a new enterprise of public utility' within the meaning of Section 182 of the constitution and subsequent legislation in pursuance of the authority therein expressly granted. It is conceded that the plaintiff is not a public service corporation, as it does not sell or distribute gas to the public at large. According to a technical and more restricted use of the phrase, it is not 'a public utility'; but at the time the exemption was granted it was a new enterprise of public utility within the meaning of said Section 182, and there is no reason to think that the legislature used the words in any narrower sense than was intended by the framers of the constitution.

"The plaintiff was organized and sought exemptions for its pipe lines and pumping plants to be used for the transportation and distribution of natural gas. It was a new enterprise, the first of its kind in the State. Crossing the Mississippi River from the Monroe gas fields, it involved physical hazards for labor and financial hazards for capital. It resulted in the expenditure within the State of about $2,000,00, and placed on the assessment rolls, after the period of exemption had expired, a valuation exceeding $1,000,000. It sells natural gas within this State to a public service corporation, to a consolidated school, and to an individual retailer thereof. It was an enterprise which looked to desirable and valuable ends, turning factory wheels, heating furnaces, shops, offices, and homes, and lightening the labors of men and women everywhere the product is brought into use. Under the facts, the plaintiff, as defined by the constitution of 1890, is an enterprise of public utility, just as many factories are, although privately owned, operated for private profit, and not dedicated to a public use; that is, not a public utility in a technical sense.

"The third contention of attorneys for defendants is that plaintiff's property is not used for distribution of natural gas. Attorneys for plaintiff in reply contend, first, that the law clearly exempts from taxation 'all conduit and pipe lines,' without further qualification; second, that there is a comma placed after 'all conduit and pipe lines,' and that there is no comma after 'appliances' where the qualifying phrase begins; third, that the word 'and' should read 'for' between the words 'transportation and distribution.' But is not necessary for us to construe the act with such precision at this time, because, regardless of whether 'all conduits and pipe lines' are qualified by the phrase requiring distribution of natural gas or not, we are satisfied that the plaintiff is engaged 'in the transportation and distribution' of natural gas as a wholesale distributor, and that the statute does not limit grants of exemption to distribution to the ultimate consumer. Any 'transportation and distribution' within the State is sufficient to obtain the exemption if the other requisites are present.

"The temporary injunction heretofore issued, restraining the defendants from assessing plaintiff's property described in the bill, should be made final, and a decree may be entered accordingly."

Tests in Turner Valley Show Pressure Decline

CHATHAM, Ontario, Oct. 21.—Pressure tests conducted in the Turner Valley Field in September show a material reduction in closed pressure in the past seven or eight months, according to a report by William Calder, director of the petroleum and natural gas division of the Alberta lands and mines department. The report says:

"A summation of the total pressures obtained in November, 1932, gave an average of 1,010 pounds while that for the later tests, excluding the new pressures obtained by the Freehold-Marjon's No. 4 and Model No. 2 wells, averaged 880 pounds. The latter, reduced by the average well producing days, gives a daily pressure decline of .45 pounds.

"During the period under review—November, 1932, to date of present tests—the quantity of gas withdrawn from Turner Valley wells is estimated to have amounted to 71,430,000,000, equalling a withdrawal of 54,900,000,000 per 100-pound decline in pressure, the daily withdrawal approximating the maximum figure set by the legislature. The lowest pressures—535 to 740 pounds—are from wells in Section 20-19-2w5, known as the Home area."

From Mr. Calder's deductions, this portion of the field as operated is a daily increasing danger to the remainder of the field.

In the September tests the highest closed-in pressure recorded was Merland Oil Co.'s No. 1 in South Turner Valley, which had dropped from 1,790 to 1,690 pounds. Pressures in the newer sections of South Turner Valley ran about 1,000 pounds, with Freehold-Marjon's No. 4, a new well, recorded at 1,660 pounds. Home Oil Co.'s No. 3 in Section 20-19-2w5, showed 535 pounds pressure, the lowest in the Turner Valley; and wells in this closely drilled section were not over 687 pounds. In the Central Turner Valley, the oldest producing section, pressures ranged higher than in the Home section and showed as a rule less decline, while in the North Turner Valley, with only three deep lime producers, pressures ranged from 1,395 to 1,500 pounds. Model's No. 2 in this area, a recent completion, recorded 1,415 pounds. Pressure declines in old wells from November, 1932, to September, 1933, ranged from 7 pounds in McLeod Oil Co.'s No. 1, Section 1-20-3w5, to 225 pounds in Mayland Oil Co.'s No. 1, Section 17-19-2w5.

Kansas Rate Reduction to U. S. Supreme Court

TOPEKA, Kans., Oct. 23.—The Kansas gas case is to be argued before the Supreme Court of the United States November 13. Earl Hatcher, former assistant attorney for the Corporation Commission, who conducted the case before the old Public Service Commission, has been notified the court would be ready to hear the arguments next month.

The State Public Service Commission first ordered the city gate rate for gas furnished distributing companies by the pipe line unit reduced from 39.5 to 29.5 cents, and later issued a supplemental order fixing the gate rate at 30 cents. The three-judge Federal court overturned the commission's ruling and held that an 8 per cent return on invested capital was not unreasonable and that the present gate rate was not an unreasonable charge. Judge Richard J. Hopkins of the U. S. District Court, who sat in the case, dissented from the rulings of Judge George H. McDermott and Judge Orle L. Phillips. Judge Hopkins held that the 40-cent rate was an unreasonable charge and should be reduced to the figures set by the commission.

L. B. Denning Is Named President Texas Cities

L. B. Denning, president of the Lone Star Gas Co., has been elected president of the Texas Cities Gas Co., succeeding the late H. C. Morris. The board also elected Chester L. May vice president and general manager of Texas Cities Gas Co., which position will be held simultaneously with that of vice president and general manager of the Community Natural Gas Co., which Mr. May has held since 1929.

L. B. Denning, Jr., has been made general superintendent of the eastern divisions, which include Brenham, Waco, Paris and Galveston in Texas Cities, and the following Community Natural divisions: Bonham, Greenville, Marlin, Temple and Terrell.

M. L. Bird, formerly field superintendent for Community Natural, has been appointed general superintendent of the western divisions in charge of El Paso and Juarez in the Texas Cities group and the following Community divisions: Abilene, Brownwood, Eastland, Frederick, Hamilton, Handley, Itasca, Pilot Point, Vernon, Wynnewood, and the Sweetwater division, which includes operation of the Stamford & Western Gas Co. and the Northwest Texas Gas Co.

Merchandising activities on both Community Natural and Texas Cities Gas Co. properties will be under the supervision of C. L. Trevitt. Mr. Trevitt has served as new business manager of the Community Natural since March 1932.

GAS FOR TOMBALL

HOUSTON, Tex., Oct. 23.—The Moran Corp. of Houston has been granted a franchise to construct and operate a natural gas distribution system in the recently incorporated town of Tomball, northern Harris County. Construction of the system must begin within 60 days. Gas will be supplied from the new Tomball Field, which adjoins the town of the same name. Tentative arrangements have been completed by the Moran Corp. for the purchase of gas from Magnolia Petroleum Co.'s No. 1 Rudel, a 50,000,000-foot dry gasser located nearest the town.

The Moran Corp. owns and operates the gas distribution system at Conroe and supplies gas as fuel for operations in the Conroe Field.

DURING THE WORST YEAR OF THE DEPRESSION *this Sales Plan sold*

MILLIONS OF GALLONS OF GASOLENE TO HUNDREDS OF NEW ACCOUNTS

You CAN SHARE ITS BENEFITS

THIS GREAT SALES PLAN was developed, launched and proved successful by Cities Service during the worst year of the depression. In a period of greatest sales resistance, it sold millions of gallons of gasolene to hundreds of new customers. Six out of every ten prospects approached were sold.

Now Cities Service is ready to share its benefits with you ... right at the time when business is getting better ... the time when orders are getting larger.

Be the first in your territory to use and profit from this proved plan ... a plan absolutely new and different. Nothing like it has ever been offered to you.

Wire, 'phone or write for details at once. Be out front in the profit parade. Address the nearest subsidiary listed below.

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ONCE - ALWAYS

For further information write, wire or telephone:—

CITIES SERVICE OIL CO. (MICH.) Adrian, Mich.	CITIES SERVICE OIL CO., LTD. Toronto, Canada	EMPIRE OIL & REFINING CO. Tulsa, Okla.
CITIES SERVICE OIL CO. (OHIO) Cleveland, Ohio	CITIES SERVICE REFINING CO. Boston, Mass.	LOUISIANA OIL REFINING CORP. Shreveport, La.
CITIES SERVICE OIL CO. (WIS.) Milwaukee, Wis.	CREW LEVICK CO. Philadelphia, Pa.	A. R. NEWCOMBE OIL CO. Kingston, N. Y.

CITIES SERVICE OIL CO. (DELAWARE), Tulsa, Okla.

NRA

CITIES SERVICE OILS AND GASOLENES

FIELD PROBLEMS FROM READERS

Edited by Thomas F. Smiley

This department is conducted in order that men connected with the drilling, producing and transporting branches of the petroleum industry may obtain aid in solving problems that confront them in their work. Readers are invited to send questions freely. These questions will be placed in the hands of persons capable of answering them authoritatively, and the answers, based on the best available information, will be published.

Each question should give as much detail as possible, especially if it involves depth of sands, types of sands and operations on adjoining or nearby properties. The source of questions will be considered confidential, and only the initials of the sender will be published. Questions involving patented processes, intricate formulas or estimates of cost cannot be answered. If an immediate answer is important, one will be given by mail when the writer requests it.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or improved old ones.

Russian Asks Information About Seamless Rotary Drillpipe

I would like to obtain from you information regarding upset seamless rotary drillpipe.

1. What grade steel is the most widely used in making rotary drillpipe for deep-well drilling in America?

2. What is the chemical analysis of grades B, C and D steel indicated in the A.P.I specifications

3. Do they use alloy steel drillpipe in American oil-field operations?

4. Is the so-called "heat-treated" rotary drillpipe recommended for deep-well drilling, and what results have been accomplished?

5. Do American oil operators resort to annealing fatigued drillpipe to recondition it?—B. M. S., Grosny, U. S. S. R.

1. The grade of steel now most commonly used in the United States for deep well operations is the A.P.I. grade D. For specifications see pages 6 and 8 of "A.P.I. Standards No. 5-A." It is a basic open-hearth steel of approximately .25-.40 carbon. The most successful steels have contained, in addition to the carbon noted, substantial quantities of manganese in order to give the higher tensile strength required for this class of work without sacrificing necessary ductility, as would be the case with more increase in carbon.

2. The chemical analysis of the various grades of steel as listed in the A.P.I. specifications varies somewhat with the different manufacturers. Chemical limits are not defined closely since the criterion of the grades is the physical properties of the material and the various manufacturers are permitted leeway to meet these physicals in conformance with what they believe to be the best practice. In general, the practice is to start with about a .30 per cent carbon steel on grade B, increasing the carbon and manganese content for the different classes of material.

3. It is difficult to estimate the percentage of rotary upset drill pipe made from the alloy steels, but in fields where drilling is severe it is believed to be practically 100 per cent. Most manufacturers meet grade D specifications by the use of alloy steels, often the alloy being manganese, the quantity of which varies with the carbon content and with thermal treatment given the pipe after rolling.

4. Opinions and practice differ with reference to heat-treated drill pipe. Only one company in the United States is said to make what usually is indicated by the term "heat-treated" drill pipe. This treatment consists of quenching the steel from above the critical temperature, in water, and then annealing to meet the elongation specifications and to give a microstructure suitable for the purpose of the product. According to the manufacturer it results in a drill pipe having exceptional resistance to fatigue. This kind of drill pipe has been used extensively in deep well operations throughout the Mid-Continent and Pacific Coast territories. Other manufacturers say that owing to certain difficulties encountered in the process, they prefer to get the desired physical properties by some other means.

5. The question regarding the advisability of annealing used rotary drill pipe has been raised many times in this country. The practice has never been resorted to widely. Failures in rotary drill pipe are said to result principally from fatigue. Annealing would not remove, and might even aggravate, small incipient cracks resulting from fatigue. Also surface cuts resulting from service would still remain, often to act as centers for localized stress, tending to hasten failure by fatigue. In addition, annealing might be harmful to the material by reducing the tensile properties. Normalizing might, in certain cases, be beneficial, but also this treatment would not remove small cracks and surface conditions referred to and it is a commonly held opinion that the results obtained would not justify the cost. There are records in this country of strings of drill pipe which have drilled over 100,000 feet of hole. However, the practice generally is to discard the pipe and sell it for line pipe use when about 15,000 to 20,000 feet of hole has been drilled. No definite rule for this can be laid down, as much depends upon the severity of use to which the pipe has been subjected.

Desires Information Concerning Several Geological Questions

I am seeking information on features in the Enid group. How may the Herington limestone be identified? What is meant by unconsolidated shales? What is a conchoidal fracture?—J. W. G.

Replying to your first question about the Herington limestone, Van Wiebe's "Oil Fields in the United States," gives a generalized section of the Big Blue series of the Permian system in Kansas and shows the Herington below the Pearl shale, which in turn is beneath the Wellington. This is a fossiliferous lime and Dr. C. N. Gould has listed the fossils in his Bulletin 35, Oklahoma Geological Survey. However, without going into that detail it is fairly safe to assume that the first fossiliferous lime penetrated beneath the Wellington salt or gypsum beds is the Herington. It is so high in the section in Oklahoma that it is not of much importance for identification purposes and geologists who are interested in it in Kansas have usually studied it at its outcrop in Marion County. This likewise applies to Oklahoma geologists but they do not generally work with it much.

Dorsey Hagar in his book, "Practical Oil Geology," states: "Clay is made up of very fine-grained particles principally of aluminous materials containing considerable water. Clays are formed in deeper water than sands. Shales are laminated rocks made up from hardened muds, silts or clays as result of pressure." It therefore would seem to follow that unconsolidated shales were muds, silts or clays to which no pressure or only relatively light pressure had been applied by overlying formations. This brings up the question of demarcation between muds, silts or clays and shale and until the pressure has been applied it would seem that shale has not been formed. Therefore the term "unconsolidated shale" may be a misnomer.

A conchodial fracture is a term applied to an elevation or depression in form like half a bivalve shell. The term is descriptive of the general appearance of the elevation or depression and compares it with the shell of marine animals, having what are commonly known as "conch" shells. Oysers and mollusks belong to this general group. A fracture is an open break. The direction and the details of the surface of fracture are determined by the internal strength of the material fractured. In these respects a fracture is distinguished from a shear, which is a smooth cut. However, a shear may develop from a fracture or it may disperse into fractures.

Why Was It Called That?

ENGINE

The word engine, which actually covers any instrument by which any effect is produced, is restricted largely in mechanics to mean the steam engine or some analogous machine, as the air, gas, gasoline, hydraulic and oil engines. It is derived from the Latin word ingenium, meaning natural capacity, invention. The engineer often refers to his engine as "she." Somebody has suggested this is because engines wear jackets, with yokes, pins, shields and stays. They have aprons, pumps and hose, and even drag trains behind them.

Use of Chemicals for Removal of Paraffin Deposits in Wells

May I ask for some information concerning the use of chemicals to remove paraffin from wells? My understanding is that there are certain chemicals which can be introduced into the well and which will dissolve the paraffin so that it can be taken out with a bailer. Some of the old wells in this region are so clogged with paraffin that they will have to be abandoned if there is no way of getting the paraffin out.—N. E. R.

Chemical treatment of wells that have accumulated paraffin is common practice and may take two general forms. By mixing chemicals heat may be developed in the well that will melt the paraffin so that it may be pumped out with the oil. Other chemicals may be used that will dissolve the paraffin without producing appreciable heat.

Heat may be applied by several other means. Introducing high pressure steam into the well is one of them. Another method is to encase a heated drilling bit in a short joint of casing that has been closed at both ends and lowering the hot bit into the hole.

Where the wells are produced by gas lift it is common practice to heat the gas as it is introduced into the well and this prevents the formation of paraffin on the walls of tubing or casing.

In Bulletin 348, U. S. Bureau of Mines, C. E. Reistle, Jr., discusses "Paraffin and Congealing-Oil Problems" and outlines several heat-forming chemical combinations that have been used with success in various fields.

A number of chemical compounds can be used to generate heat in oil wells, and several different ones are on the market for removing paraffin.

One advantage of using the lye and aluminum compound is that the products of the reaction are liquid and strongly alkaline and will not damage the sand or reduce its permeability as might happen with acids.

R. Van A. Mills suggests the use of calcium carbide and water as a means of generating heat. The reaction of calcium carbide and water generates approximately 200 B.t.u. of heat per pound, and is therefore less efficient than the reaction of aluminum and lye and iron oxide and aluminum compounds. Moreover, the cost of materials is greater. Mr. Mills also suggests the use of sodium peroxide, which reacts violently upon the addition of water and generates considerable heat with the liberation of oxygen. If sodium peroxide were used with aluminum it would produce in all probability more heat than any of the other chemical reactions mentioned, but sodium peroxide is difficult to store without deterioration, and is dangerous to handle. Sodium peroxide also generates heat and liberates oxygen, and it bursts into flame when brought in contact with water or damp objects and therefore constitutes a great fire hazard. The use of strong acids and acids with other chemicals is not advisable, because they damage the metal equipment of the well and affect the producing sand adversely.

There are companies now serving the oil industry who specialize in cleaning old wells. As it is always possible to do damage to a well by the introduction of chemicals or foreign material into the hole without giving full consideration to the reactions that will occur it is suggested that you consult with one of these companies.

OUR 1933 MODELS

Include five sizes skid-type servicing winches for truck mounting —five sizes servicing winches for mounting on "Caterpillar" tractors—a size to fit wells of every depth.

ATTACHMENTS

Rotary drilling Standard drilling
Clean out operations
Well deepening operations
Double drums Spudding

Let us send you photographs of our Rotary Table Drive and Standard Drilling attachments for our servicing winches, with which a well may be drilled with a rotary and finished with standard tools. An hour's time to change from rotary to standard tools.

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P. O. Box 2276 Wichita, Kansas Phone: Long Dist. 289

PERSONAL PARAGRAPHS

F. G. GRUNDER, sales manager, Jones & Laughlin Steel Corporation, Pittsburgh, Pa., was a recent Tulsa visitor.

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M. G. CHENEY, president of the Anzac Oil Corporation, Coleman, Tex., has returned from a business trip to Oklahoma.

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WALTER GANT, of Oklahoma City, Okla., is in Clay County, Texas, supervising the completion of a wildcat well on the Worsham ranch.

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L. C. REA, district material man for the Atlantic Pipe Line Company, Midland, Tex., has been transferred to the Greta Field in Refugio County, Texas.

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W. W. RUBEY, geologist with the U. S. Geological Survey, who has been working on the Afton quadrangle in Wyoming, has returned to Washington, D. C.

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S. C. YINGLING, president, and J. P. Chalmers, secretary-treasurer, of the Southern Petroleum Corporation, Fort Worth, Tex., have transferred their offices to Abilene, Tex.

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MR. AND MRS. W. C. HOON, of Glencoe, Ontario, celebrated their twenty-fifth wedding anniversary on September 15. Mr. Hoon is extensively interested in the Mosa oil fields near Glencoe.

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L. C. ROBERTS, geologist for the Stanolind Oil & Gas Company, has been transferred from Fort Worth, Tex., to Houston, Tex.

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E. L. SAURER, Republic Oil & Refining Company, Houston, Tex., has returned from a vacation, part of which was spent in Oklahoma.

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W. J. SHERMAN, Houston, Tex., secretary to the division manager of the Texas Company, spent his vacation at the World's Fair in Chicago.

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GEORGE PIRTLE, geologist and member of the consulting firm of Hudnall & Pirtle, Tyler, Tex., has returned from an airplane trip to Mexico City, Mexico.

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C. H. FOX AND W. O. LEEK, Garber, Okla., oil men, were injured seriously as a result of a collision north of Guthrie between their automobile and a freight train.

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GLENVER McCONNELL, mechanical engineer, Shell Petroleum Corporation, Tulsa, is expected back in about 10 days from a four weeks' vacation trip. Mr. and Mrs. McConnell have been as far east as New England, stopping to visit friends in Ohio and to see the World's Fair at Chicago.

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LEE WORTH, production superintendent for the Stanolind Oil & Gas Company, of the Gulf Coast, with headquarters at Houston, Tex., has been moved to Wichita, Kans.; D. G. Safford has been moved to Houston from McCamey, Tex., to take charge of the Gulf Coast district; L. L. Bechtel has been moved from Wichita, Kans., to Midwest, Wyo.; and C. W. Jones from Midwest, Wyo., to Gorham, Kans.; L. E. Sloan has been moved from Hobbs, N. Mex., to McCamey, Tex., and J. P. Gibbons has been put in charge of production in the Hobbs Pool.

MR. AND MRS. E. L. BAIRD, of Negritos, Peru, are spending three months' furlough in Petrolia and Toronto, Ontario. Mr. Baird is head of the transportation department of the International Petroleum Company in Peru.

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U. G. HOUDRY, president of the Houdry Process Corporation, New York City, and R. C. Laffiat engineer, left October 20 on the Paris of the French line for France. They will visit Paris and other European points, returning to the United States in about six weeks.

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LEWIS EMERY, of Bradford, Pa., Pennsylvania and Oklahoma oil producer, has returned from an European trip, which took him as far east as Dalmatia in Jugo-Slavia. He reports European business conditions much improved, particularly in the past few months. Mr. Emery is a frequent European visitor.

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WILLIAM F. HUMPHREY, president of the Tide Water Associated Oil Company, San Francisco, Calif.; E. L. Shea, president of the Tide Water Oil Corporation, New York; J. Paul Getty, San Francisco, a large stockholder and independent operator; E. H. Salrin, president, and R. B. Pringle, vice president, of the Tide Water Oil Company, Tulsa, comprised a party which visited the Houston, Tex., offices of the company the past week.

D. C. MILLER, Tulsa, administrator of the holdings of Miller & Terrell, oil operators, has been in Houston, Tex., on business.

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T. S. LOVERING, of the U. S. Geological Survey, is making extensive tunnel site examinations in northern Colorado and southern Wyoming.

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R. E. LESLIE, superintendent of the Humble Pipe Line Company station at Satsuma, Tex., spent a vacation trip at the World's Fair in Chicago.

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GEORGE C. LAW, petroleum engineer, Denver, Colo., office of the U. S. Geological Survey, is making an inspection trip through western Colorado.

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W. P. Z. GERMAN, general counsel; Emby Kaye, director of manufacturing, and A. F. Winn, traffic manager, have been elected directors of the Skelly Oil Company.

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E. A. HOLBEIN, in charge of tank car sales for the Standard Oil Company of New Jersey, New York City, visited in Parkersburg, W. Va., and other points last week.

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FRANK E. McMILLAN, JR., of Tulsa, has been chosen as president of the Reiter-Foster Oil Corporation, and Charles Schirmer of Boston, Mass., and Frank Mason of Texas, as new directors.

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HERBERT WOOLLEY, representative for Coffing Hoist Company of Danville, Ill., was a recent visitor in Tulsa.

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W. B. SHAKELY, superintendent of the telephone and telegraph department for the Sinclair Prairie Pipe Line Company, Fort Worth, Tex., and Mrs. Shakely, have returned from a vacation trip spent in Pennsylvania, principally around Pittsburgh.

• • •

HARRY BOWMAN, oil marketer, with stations in northern Pennsylvania and southwestern New York, and Mrs. Bowman, have returned to their home in Bradford, Pa., after a visit in Tulsa with their son, W. R. (Bud) Bowman, who represents the Emery interests in the Oklahoma Field.

• • •

E. H. EDDLEMAN, of Fort Worth, Tex., for the past two years manager of the Texas Oil and Gas Conservation Association, is now in Washington taking over the position of secretary to the production subcommittee of the Oil Code Planning and Co-ordinating Committee. Mr. Eddleman was formerly manager for the American Refining Properties Corporation at Wichita Falls, Tex.

• • •

FRED VAN COVERN, director of the department of statistics of the American Petroleum Institute, has been loaned to the Planning and Co-ordinating Committee for the petroleum industry under the NRA. Mr. Van Covern will maintain headquarters in Washington with offices in the Shoreham Building, and will organize a department to carry on statistical and economic studies. He will take with him to Washington, Joseph P. Buder, a member of the Institute's statistical staff. The department of statistics in the New York headquarters of the Institute will continue to function under Mr. Van Covern's supervision.

HAD VARIED EXPERIENCE

H. K. V. Tompkins, recently named manager of exploration east of the Rocky Mountains for the Continental Oil Company by D. J. Moran, president of that organization, has had broad experience in varied types of engineering work, specializing for the last 10 years in oil exploration work. He attended Cornell University and Union College, leaving school in 1908 to do engineering work for the Canadian-Niagara Power Company. After a year he joined the Washington Power Company, spending four years in engineering work in Idaho, Washington and Montana. During the next five years Mr. Tompkins devoted his time to engineering work for public utilities groups in Tennessee and Texas, building dams and transmission systems, in evaluating, buying and rehabilitating various utilities.

H. K. V. TOMPKINS

Mr. Tompkins' first introduction to the oil business came in September, 1917, when he joined the Gulf Oil Corporation in Houston, Tex. A year later he was made chief engineer of the Gulf Pipe Line Company, in charge of all engineering throughout the Southwest. During this period he built the first complete electrical oil field installation, in the Goose Creek, Texas, Field.

In January, 1921, Mr. Tompkins was sent to Mexico as executive in charge of the Mexican-Gulf Oil Company, supervising all Gulf activities there. In January, 1929, he returned to Houston as assistant to the Gulf vice president in charge of all operations in the Southwest.

At the end of 1931 Mr. Tompkins left the Gulf and in March, 1932, he became personal representative for J. Paul Getty, establishing headquarters in Los Angeles, Calif., and was in charge of the work of merging several production companies into one unit under Mr. Getty's ownership. He remained in that position until he joined the Continental Oil Company.

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JOE MEYERSCOUGH, of Wichita Falls, Tex., and East Texas, has moved to San Antonio to live.

* * *

ROBERT ROTH, consulting geologist, has returned to Tulsa after a trip to Colorado.

* * *

E. A. WAHLSTROM, engineer for the Stanolind Oil & Gas Company, has been transferred from Hobbs, N. Mex., to Midland, Tex.

* * *

GEORGE A. HILL, JR., president of the Houston Oil Company, Houston, Tex., has been chosen director-general of the Houston Community Chest for this year.

* * *

F. JULIUS FOHS, consulting geologist, Houston, Tex., was the principal speaker at the meeting of the Houston Geological Society. He talked on "Structures and Oil Possibilities of Sicily Island."

* * *

JOHN JONES, associate technologist of the U. S. Geological Survey, at Midwest, Wyo., is ill at the Fitzsimmons General Hospital in Denver, Colo. Late reports were that his condition did not show much change.

* * *

W. R. RAMSEY, president; R. M. Franks, vice president, and C. L. Wagner, geologist, of the Ramsey Petroleum Corporation, are in Colorado to witness the completion of that company's No. 1 Scrivens, in Weld County.

* * *

A. E. DUNSTAN, chief chemist of the Anglo-Persian Oil Company, London, England, spent several days in New York City last week en route to Chicago where he attended the annual meeting of the American Petroleum Institute.

* * *

WALTER J. BOYLE, geologist, formerly with the Indian Territory Illuminating Oil Company, at Bartlesville, Okla., and the Transcontinental Oil Company in Texas, is now working in the San Antonio, Tex., district for the Phillips Petroleum Company.

* * *

W. W. CLAWSON, district geologist for the Indian Territory Illuminating Oil Company, at Oklahoma City, Okla., resigned recently to join the forces of the Magnolia Petroleum Company.

* * *

JOHN CRAM, scout and land man for the Continental Oil Company, San Angelo, Tex., and family, have returned from a vacation trip to the Fair at Chicago and a visit with relatives in Marietta, Ohio.

* * *

F. W. PEMBERTON, district manager of the Union Oil Company, of the Los Angeles area, has been appointed divisional manager and in his new capacity will have charge of all southern California territory.

* * *

WESLEY WEED, Sun Oil Company, Houston, Tex., and Miss Marguerite Ray of Tyler, Tex., were married in Tyler on October 16, and left immediately on a honeymoon trip to San Antonio, Tex., and Monterrey, Mexico.

* * *

N. V. VANNINKOFF, of the U.S.S.R., is in charge of a party of six Russian oil men who are making a study of the Permian Basin oil fields. The party recently came from New York and set up headquarters at Midland, Tex.

* * *

JOHN A. RITTER, general superintendent of production for the Sun Oil Company, Dallas, Tex., and Mrs. Ruth Kellogg were married in that city on October 10 and are now attending the Century of Progress at Chicago and visiting other northern cities.

* * *

NELSON K. MOODY, president of Sinclair Prairie Oil Marketing Company, and Dana H. Kelsey, vice president of Sinclair Prairie Oil Company, both of Tulsa, were in Cheyenne, Wyo., in connection with the Producers & Refiners Corporation sale.

RUSSELL OWEN, of the Casper, Wyo., offices of the U. S. Geological Survey, and Mrs. Owen are the parents of a baby daughter, born Friday, September 29.

* * *

L. R. CRAWFORD and P. C. Spencer, of Independence, Kans., receivers for the Producers & Refiners Corporation, were in Cheyenne, Wyo., this week to attend the hearing in the Federal District Court on an application of the Consolidated Oil Corporation for an order for the sale of the properties in receivership.

* * *

F. H. DICKISON is now with Thomas M. Bowers Advertising Agency, New York, as a member of the executive staff. Mr. Dickison was in charge of sales and advertising for Tydol gasoline and Veedol oils and greases for seven and one-half years, including three years as vice president and general manager of Tide Water Oil Sales Corporation.

* * *

GEORGE W. SNEDDEN, vice president of the British American Oil Producing Company, who has been critically ill in his home in Tulsa, is reported as showing marked improvement. Mr. Snedden, who suffered a heart attack several weeks ago, had so far recovered that he was planning to return to his office, when he contracted a cold which caused a relapse.

* * *

G. B. AGAVERDIEV, first vice president and general manager of drilling and production for Azneft in Baku, Russia, is now in New York City heading a group of Russian engineers who have been inspecting oil fields in the United States studying drilling and operating methods. Other members of the party include A. A. Toherkassov, general superintendent of drilling in the new fields of Surakhany in Baku; M. B. Badalianz, superintendent of drilling for Meineft in Maikop; D. A. Muradbeili, general superintendent of drilling in the oil fields at Surakhany in Baku, and P. J. Sechevoy, general superintendent of drilling at Leninsky in Baku.

DALTON LAIN, of San Antonio, Tex., recently made a trip to Tulsa.

* * *

J. B. D. WOODBURN, representative in Seminole, Okla., for Chemical Process Company, is spending a few days at headquarters in Breckenridge, Tex.

* * *

R. K. AKRIDGE and Mrs. Akridge, Dr. B. S. Kyle and Mrs. Kyle, and S. E. Townsend, all of Los Angeles, Calif., were in Casper, Wyo., last week.

* * *

MAJ. J. B. THOMAS, vice president of the Texas Electric Service Company, Fort Worth, Tex., has been named colonel in charge of the community chest drive of that city.

* * *

JESS SCARBROUGH, head of the land department of the Mid-Continent Petroleum Corporation, Tulsa, has been inspecting the Houston office of the company and the Texas Gulf Coast district.

* * *

W. H. FERGUSON, general chairman of regional committee for the Fifth Region of the NRA code, of Denver, Colo., is in Washington and New York conferring with oil men and administration officials.

* * *

M. HALSTEAD, paleontologist, has returned to the Amerada Petroleum Corporation after spending the last two years in research work. He is in the Gulf Coast district with Houston, Tex., as headquarters.

* * *

JACOB FRANCE, president of Mid-Continent Petroleum Corporation, Tulsa and Baltimore, has left for New York City, from where he plans to sail for Europe. He expects to spend the next two months visiting in several countries there.

* * *

GEORGE GIBSON, JR., sales engineer for the C. H. Leach Company, has returned from the Mid-Continent to the New York City headquarters of the company. He will return to the Tulsa offices of the company the latter part of the month.

* * *

CARL WALKER, recently employed by the U. S. Geological Survey, is working in the Mexican Hat district, in Utah.

* * *

E. McCUNE, superintendent of the land department for the Sun Oil Company, Dallas, Tex., is in Chicago on business.

* * *

L. E. TAYLOR has been transferred from Thompson to Hull, Tex., as superintendent for the Humble Oil & Refining Company.

* * *

D. W. HOVEY, vice president and general manager of the Republic Oil & Refining Company, Houston, Tex., is away from his office on a business trip to the East.

* * *

K. L. HALL, formerly sales manager of Baash-Ross Tool Company, has joined the Lane-Wells Company, Los Angeles, Calif., where he will take charge of sales and rentals.

* * *

FRED HAYES, former sales manager, National Transit Pump & Machine Company, is now sales manager of the pump division of Worthington Pump & Machinery Corporation.

* * *

JOHN WEST, formerly with the Geophysical Research Corporation, at Houston, Tex., has been transferred to Baton Rouge, La., as land man with the Amerada Petroleum Corporation.

* * *

W. A. LEARY, district agent for the Sinclair Oil & Refining Company, Fort Worth, Tex., who was seriously injured in an automobile accident on the Archer City-Wichita Falls highway on October 17, is reported recovering.

* * *

W. G. TIERNEY, land man with the Amerada Petroleum Corporation, has been transferred to Wichita, Kans., after spending the past three months at Baton Rouge, La.

DO YOU REMEMBER?

From The Oil and Gas Journal Files

25 Years Ago

October 25, 1908

The Prairie Pipe Line Co. now has permits to lay its lines in Washington, Nowata, Rogers, Pawnee, Osage, Creek, Tulsa and Muskogee Counties in Oklahoma.

C. H. Colcord, who is associated with Robert Galbreath in the Glenn Pool in Oklahoma, has just returned from Alaska where he has acquired extensive mining interests.

W. N. Robinson has again taken over the Robinson Hotel in Tulsa and will make extensive improvements in it. It was this fine modern hotel that started Tulsa on its rapid progress upward. It is now a city of 17,000 people.

L. S. Gordon and J. S. Thompson, Gulf pipe line superintendents, have concluded a 340-mile horseback ride of inspection of the company's pipe line system from Chambers Station, Okla., to Sour Lake Station in southern Texas. The Journal's humorous columnist hints that they trained for the trip by riding walking beams at night in the Glenn Pool.

20 Years Ago

October 30, 1913

Gasoline is retailing at an average price of 20 cents per gallon in the United States. There is no tax.

A government report says that in 1912 there were 250 casinghead gasoline plants in the United States and that they manufactured 12,081,179 gallons of gasoline. This was an increase of 76 plants and 4,655,340 gallons of gasoline over the 1911 record.

Isaac Ralph, of Ralph Brothers, oil producers, dies in Bradford, Pa., age 69 years.

John B. Young, for 35 years employed by the Standard Oil Co., dies in Philadelphia, where he was agent for the National Transit Co., one of the Eastern group of Standard pipe lines. He was 71 years of age.

Charles Page, Oklahoma oil man, built and maintains an orphanage and homes for widows at Sand Springs, Okla. He was a poor boy who has become a multimillionaire in oil and gas.

10 Years Ago

October 25, 1923

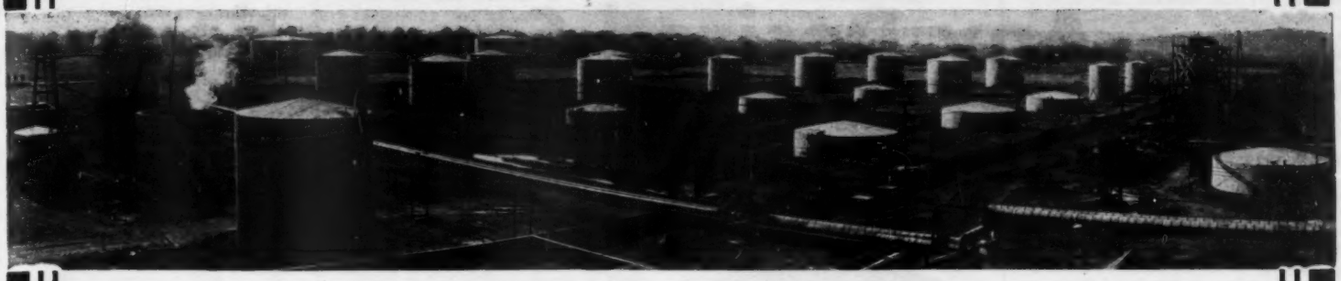
The Powell Field in East Central Texas reaches a daily production of 317,000 bbls.

The Prairie Oil & Gas Co. and the Producers & Refiners Corp., through their executives deny that there is any truth to the rumor that the two companies will be merged.

B. A. Simpson, pioneer oil operator in the southern Oklahoma fields, dies in Ardmore, Okla.

Dixie Oil Co. pays (according to current report) $3,000,000 cash for the Seminole properties of R. H. Smith, who opened the Wewoka Field. Mr. Smith had been wildcatting in the Seminole area since 1914. It was considered barren by some oil men.

FIELD STORAGE and REFINERY EQUIPMENT



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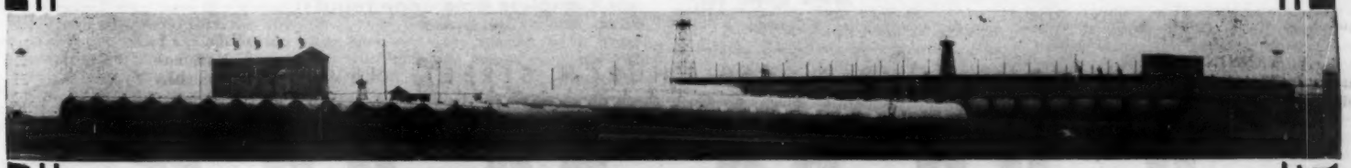

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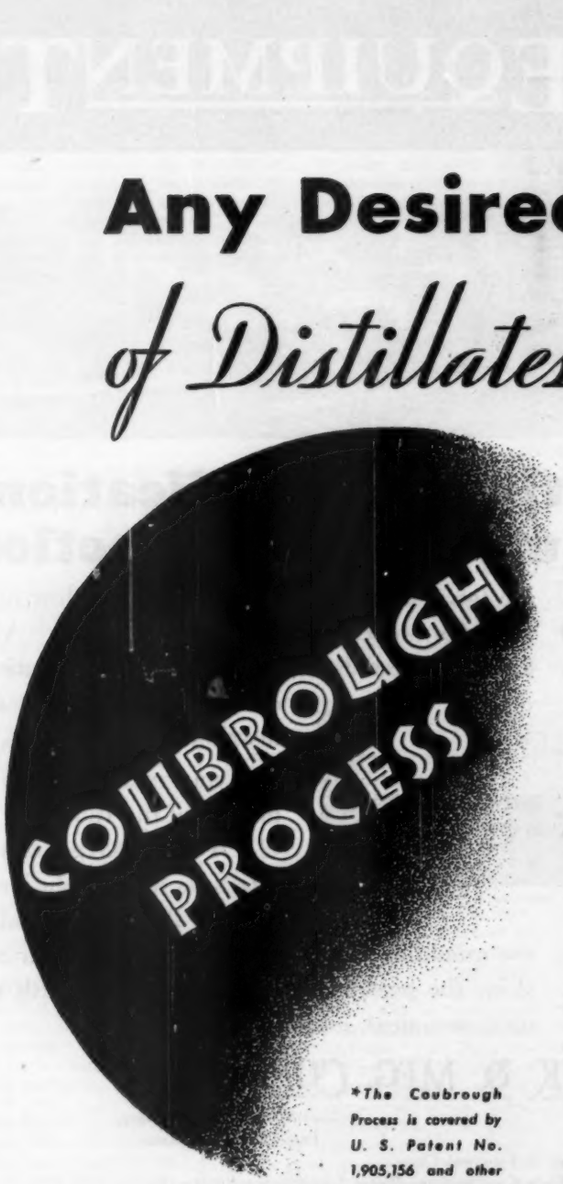

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PETROLEUM REFINING PLANTS

TECHNICAL QUESTIONS ANSWERED

By Charles K. Francis, Ph. D., Technical Editor

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible.

Inquiries must be signed but only the given initials will be printed. The source of the questions is considered to be confidential.

Questions requiring a discussion of patents, the use of intricate formulas, extended computations, or cost estimates cannot be considered.

When the matter is of general interest the reply will be published within a reasonable time.

Cracking Capacities of Units in the United States

What is the total charging capacity of the cracking units in the United States? Has any definite ratio been established between these crude and cracking capacities? Where is the largest volume of oil cracked; that is, what state?—G. H. E.

The total charging capacity of the cracking units of the United States, was on January 1, 1932, according to the U. S. Bureau of Mines, 2,046,981 bbls. a day. The survey of The Oil and Gas Journal indicated that the actual capacity of the cracking units in operation March, 1933, was 1,696,821 bbls. While there has been an increase in the number of cracking stills within the past five years, there have been a number which have become obsolete. G. R. Hopkins states in Bureau of Mines, Circular 6648:

"Until five years ago, most of the capacity that was added consisted of new equipment; but the last few years have witnessed a tendency to increase the potential throughout by modernizing existing units. It is estimated that at least 125,000 bbls. of daily cracking capacity was added through remodeling in 1931, compared with about 150,000 bbls. added through the construction of new equipment."

The total charging capacity for crude oil, operating refineries, was, in March, 1933, 3,540,410 bbls. a day. The largest being 855,250 bbls. charged in California. The largest cracking capacity is held by Texas, at 447,550 bbls. a day.

There is no definite relation between crude charging capacities and cracking capacities. In California it is approximately 4 to 1; in Texas not quite 2 to 1; in Oklahoma and Pennsylvania refineries the ratio is somewhat better than 2 to 1; and the reports for Maryland show a larger cracking capacity than crude capacity.

Chemical and Physical Properties of New Crude Oils

I should like to inquire if you can furnish me references to your publication wherein I may find the chemical and physical characteristics of the crude oils produced in the United States and foreign countries? If you can furnish any other references where this data may be obtained I should appreciate it immensely.—E. O. R.

The properties of the newly discovered oils, whenever found, are published in The Oil and Gas Journal, either in the form of contributed articles or in the regular departments, soon after the oil becomes known to the industry. Very frequently the Technical Questions Answered Department is asked to supply analyses of certain crude oils and, when the information is available, it is published with as much detail as possible. The subject index of The Oil and Gas Journal appears twice each year and includes all articles of a special character but does not show the subjects that have been discussed under Technical Questions.

If you do not keep your files complete I suggest that you consult the volumes of The Oil and Gas Journal available in your local library.

Analyses of crude oils may be found in numerous books; see Handbook of the Petroleum Industry, by David T. Day. Tabulated Analyses of Representative Crude Petroleums of the United States, U. S. Bureau of Mines, Bulletin 291. Petroleum and Its Products, by W. A. Gruse.

Kerosene Displacing Gasoline as Motor Fuel

Is it true that during recent years there has been a steadily increasing quantity of kerosene used in place of gasoline for motor fuel, especially in automobiles?—T. B. E.

No records are available showing the volume of kerosene consumed in the United States as motor fuel. There has been an increased demand for kerosene and this fact has been reflected in the higher prices obtained for the product. The tax on gasoline has mounted so rapidly in the majority of the states, in most instances it is more than the refiner's price, that without doubt many blends of kerosene with gasoline have been made and in some instances straight kerosene is being used for motor fuel. It is known that some of the better grades of kerosene, or kerosene which has been especially refined, when blended with gasoline makes a motor fuel which will serve.

The trend is shown in some of the countries which import all petroleum products. According to the U. S. Commerce Reports there has been an increase of kerosene motor fuel in Sweden; this use being so pronounced that the tax received for road purposes is showing a serious loss and it is now predicted that the Riksdag will consider, at the meeting next January, placing a tax on kerosene.

During the first quarter of 1933, Swedish imports of gasoline amounted to 81,410,000 liters, compared with 84,900,000 liters in the corresponding period of last year. Kerosene imports, on the other hand, rose from 7,217,000 to 11,380,000 liters in the same period. During the calendar year 1932 Sweden imported 454,000,000 liters of gasoline and 78,000,000 kilos of kerosene. About 35 per cent of these totals represented shipments from the United States.

Colloidal Fuel Handled and Used Like Fuel Oil

Is it possible for you to tell us anything in regard to the use and production of colloidal fuel which consists of a mixture of fuel oil and powdered coal? It will be appreciated if you will advise us what equipment is necessary and percentage of each required in order to obtain a homogeneous mixture, also equipment for handling and burning this material?—A. H. R.

Much attention and study was given to colloidal fuel, powdered coal suspended in fuel oil, during the war and the subject has recently attracted attention because of the successful trial of this fuel in the Cunard steamship Scythia in June, 1932. It is claimed that the presence of the suspended particles of coal results in a more intensely radiating flame, improving heat transfer. Other advantages include no modification of the usual oil-burning plant and easy handling through a pipe system. The material may be prepared at a central plant and then transported in tank cars.

The fuel must possess a reasonable stability, lasting at least 30 to 60 days. In an article on the subject, J. S. S. Brame, in Petroleum Times, October 29, 1932, page 439, outlines the methods for obtaining stability. They are:

1. To stabilize particles by the use of certain protective substances such as soap solutions, lime rosin grease being mentioned.
2. To peptize bituminous coals sufficiently by the addition of coal distillates, such as tars and the middle fractions.
3. By grinding the coal to an extremely fine size.

It is reported that the U. S. S. Gem fired a mixture containing 31 per cent coal in Navy fuel oil, this remaining stable for more than five months. About 1918 the Committee of Submarine Defense Association, New York, reported that 1 per cent protective colloid enables 30 to 40 per cent coal dust to remain suspended in petroleum oil. About 20 per cent tar may also be used. Other mixtures contain the finely powdered coal and oil in equal portions. The coal should be powdered so that 97 per cent will pass 100 mesh screen and 85 per cent a 200 mesh.

Ippears that peptizing in a similar manner to the process of Acheson, applied to the suspension of graphite in water, aquadag, and in oil, oildag, could be applied to the coal and oil mixture.

Professor Brame is inclined to the opinion that oil-coal mixtures are not liable to find favor in land plants and may be limited for marine use. Fuel oil is extensively used at sea and many vessels are equipped to burn pulverized coal and some have mechanical stokers. The storage of the oil-coal mixture in oil bunkers, or in the double bottoms of ships, and the handling by means of pumps is an advantage over ordinary coal.

A reliable stability of the oil-coal mixture is essential for there can be no deposition in the pipes, pumps and tanks to block the flow. Extra wear on the pumps and burners is to be expected. Combustion in the immediate vicinity of the burner tips cannot be so good as with oil, for it is reported that in the Scythia trial the burners required cleaning about twice as often with the oil-coal fuel as with fuel oil.

Colloidal fuel has been suggested for larger industrial plants for the purpose of producing steam. The method of handling is similar to that used for fuel oil, with slight adjustment of the burners.

Bromine For Ethyl Fluid Made From Sea Water in Land Plant

Can you tell me whether or not it is true that the bromine required for the manufacture of Ethyl Fluid, used for making Ethyl gasoline, is now obtained from sea water?—D. W. S.

We are informed that the bromine used for making Ethyl Fluid is obtained from certain brines; however, a plant is reported to be under construction near Wilmington, N. C., for the purpose of extracting bromine from sea water. In the early stages of the development of Ethyl Gasoline a floating plant was established on the steamer Ethyl, which demonstrated the possibility of sea water as a commercial source of bromine, but it was found more economical to get the element through the Dow Chemical Co., at Midland, Mich.

The Wilmington plant is the first shore plant of this character. It is being erected by the Ethyl Dow Chemical Co., a recently organized corporation formed by the Ethyl Gasoline Corp. and the Dow Chemical Co.

The quantity of bromine present in sea water is approximately 0.007 per cent and this very small quantity necessitated the treatment of such large volumes of water that it appeared the commercial recovery would not be possible. However, after extended research the chemists developed a method which was encouraging enough to warrant building the plant.

The total quantity of bromine becomes very great when large bodies of sea water are considered; for example, the potential supply of bromine in a cubic mile of sea water is about 600,000,000 pounds. This new plant is being built in units which have a monthly capacity of 250,000 pounds of bromine each. A production of this quantity will require the treatment of 13,000 gallons per minute for a 24-hour operation. The action will be so rapid that this large volume of water will undergo the chemical treatment and the bromine extracted within the minute it is in the plant.

The bromine is combined with ethylene to form ethylene dibromide, which with tetraethyl lead, constitute the chief substances contained in the Ethyl Fluid.

Kansas Fields

(Continued from Page 115)

at 1,610-20 feet and was then acidized. It had not been tested.

Harwood Oil Co.'s No. 6 Carson, NW cor. Section 33-23-11, had sand at 1,952-94 feet. It pumped 15 bbls. initially after a shot.

Theta Oil Co.'s No. 7 Shaffer, SE NW NW SE Section 31-23-14, was completed as a 10-bbl. well, sand at 1,560-74 feet.

Kite and others' No. 1 Butler, SW NE Section 15-26-11, found 3,000,000-foot gas production at 690 feet and the well was shut in for orders.

Wolf Creek Oil Co. and others' No. 2 Kaub, CNL SE NE Section 15-25-13, was drilling at 845 feet; Sheedy and others' No. 2 Aikens, SW NE SW Section 19-25-14, machine rigged up; Rex and others' No. 1-A Shook, NE SE NW Section 6-24-12, moving in machine; Hubbard Spencer and others' No. 2 Thrall, NW NE NE Section 17-24-12, spudded; Ward & McGinnis' No. 2 Beal, SW cor. Section 28-23-11, spudded; Gore & Phillips' No. 4 Brothers, NW SW NE NW Section 35-23-11, drilling at 230 feet; Theta Oil Co.'s No. 9 Young, SW NE NE Section 10-23-13, machine rigged up.

Sedgwick County

Vickers Petroleum Corp. and others' No. 3 Keys, SW NW NE Section 30-27-2e, Sedgwick County, plugged back to 3,242 feet, pumped 30 bbls. of oil and 100 bbls. of water in 24 hours.

Skelly Oil Co. and Solar Oil Co.'s No. 15 Wilson, C SW NE Section 1-26-1w, will be acidized. It tested 40 bbls. a day on the pump, pay at 2,570-75 feet.

Shell Petroleum Corp.'s No. 6-A Lygrisse, CSL NE Section 15-26-2e, had Viola lime at 3,187-90 feet. The well swabbed 1,155 bbls. in 24 hours, and then pumped 1,052 bbls. in 24 hours. It may be acidized.

Wentz and others have started drilling their wildcat, No. 1 Stockamr, SW SE Section 31-26-2w. It is a cable tool operation. Plains Petroleum Co. was drilling at 465 feet in No. 1-A Southwestern College, NE SE SW Section 2-27-1w.

Reno County

In Reno County, Mylius and others' wildcat, No. 1 Patten, SE NE Section 35-23-5w, was abandoned at 3,911 feet. It was a hole full of water from Wilcox sand, topped at 3,857 feet. There was a small showing of oil in the Wilcox.

Lario Oil & Gas Co. has made location for a wildcat test, No. 1, NE SW Section 29-23-7w. Olson Oil Co. and Shell Petroleum Corp.'s No. 2 Gorwin, C NW SE Section 35-23-4w, found a 3,000,000-foot gas production at 3,320 feet.

Cowley County

In Cowley County there were no completions, but McNabb and others had 800 feet in the hole in No. 4 Hutto, in Block 6, Winfield townsite, SE NE Section 22-32-4, coming from Silicious lime at 3,365 feet drilled in 3 feet. Van Meter and others were drilling at 500 feet in No. 1 Brooks, SW cor. Section 5-33-3. Roth & Faurot have started drilling No. 6 Brant, NW SW NE Section 12-32-4. Kansas Okla Oil Co.'s No. 1-A State, SW SE SE Section 15-32-4e, was spudded. Roth & Faurot's and Empire Oil & Refining Co. have a rig up for No. 1-A Brown, SE NE NE Section 13-31-7.

Kingman County

Skelly Oil Co. has cellar and ponds ready for No. 1 D. Rouse, C NE SE Section 20-27-10w, in the Cunningham district, Kingman County, and has started drilling No. 2 Ratcliff, CSL NW Section 30-27-10w.

Canadian Fields

(Continued from Page 110)

feet. An additional 10,000 acres was secured from Osler, Hammond & Nanton of Winnipeg; while acreage was filed on in Townships 47-7w4, 48-7w4 and 48-8w4. The old Klingdell refinery and holdings in Wainwright were also secured and Gold Standard Oils, Ltd. is reported planning to install and operate a modern refinery with an initial unit having a capacity of 400 bbls. a day. The company has contracted for Wainwright crude at a reported price of $1.20 a barrel in the field, but will carry on a systematic drilling campaign to develop further production to enable the proposed refining plant to operate to capacity.

Olsen Refining Co. of Edmonton is also reported purchasing Wainwright crude, which is being hauled to the Edmonton plant in trucks.

Drilling in Ontario

In the old Tilbury Field, Kent County, Ontario, Salina Oil & Gas Co.'s No. 5 Gifford farm, is reported drilling below 1,160 feet and close to the Tilbury sand where gas production is looked for.

In the Dover Field, Kent County, Ontario, Ajax Oil & Gas Co. of Toronto has tentatively located a test on the Antaya farm, west of Raleigh Development Syndicate's No. 1 and east of Petrol Oil & Gas Co.'s wells. Contract for the test, which will be drilled into the Trenton limestone, has been let to F. H. Stover & Son of Chatham and work will be started in about two weeks.

In Essex County, Bon Jasperson's No. 1 wildcat, Lot 14, Concession 2, Maidstone Township, is reported drilling below 2,350 feet.

In Dawn Township, Lambton County, Luke Smith's wildcat test in Lot 11, Concession 1, got a show of oil in the top of the lime at 600 feet. After drilling to 800 feet the top show was pumped out, yielding about 15 bbls.

In the Dawn gas field, Union Gas Co.'s No. 67, Lot 24, Concession 9, Dawn Township, got around 1,250,000 feet of gas in the top of the Dawn sand and is being deepened.

Wildcat Operations in Gulf Coast

(Continued from Page 116)

Sun Oil Co.'s No. 17 Wilburn, Henry Griffith League, 150 ft. W of No. 6 and 50 ft. S of N line ..... Derrick.
Texas Co.'s No. 7 Wilburn (W.O.), Henry Griffith League ..... Fishing drill pipe 5,174 ft.
Texas Gulf Prod. Co.'s No. 2-B Barber (W.O.), Henry Griffith League, 320 ft. W SE cor., 70 ft. W of S line ..... Prepare to W.O.; T.D. 5,100 ft.
Texas Gulf Prod. Co.'s No. 2 Fitzgerald, Henry Griffith League, 300 ft. W line, 80 ft. S line ..... Drlg. salt 2,949 ft.
Yount Lee Oil Co.'s No. 21 Chambers County (W.O.), Wm. Bloodgood Sur. ..... Drlg. sand and shale 4,334 ft.
Yount Lee Oil Co.'s No. 22 Chambers County, Wm. Bloodgood Sur., 300 ft. from W line, 362½ ft. from N line of lease ..... Comp. 250 bbls. in 6 hrs.; ⅝-in. choke; T.D. 5,012 ft.

BIG CREEK—FORT BEND COUNTY

C. & C. Drlg. Co.'s No. 1 Wheat, M. Young Sur., 265 ft. NE of Gulf's No. 3 Wheat ..... Drlg. shale 3,975 ft.
Gulf Stream, Inc.'s No. 1 A. H. Theis, 230 ft. E of old No. 4 A. H. Theis in line, Mitchell Young Sur. ..... Derrick.

BLUE RIDGE—FORT BEND COUNTY

San Jacinto Oil Co.'s No. 2 Blakely-E, Drew Sur., 100 ft. E, 150 ft. N of No. 1 Blakely ..... Drlg. shale 4,220 ft.

RABBS RIDGE—FORT BEND COUNTY

Humble O. & R. Co.'s No. 30-A F. I. Booth, S. Kennecy Sur., 398 ft. E of No. 19 ..... Rigging.
Humble O. & R. Co.'s No. 7 M. Gubbles, S. Kennedy Sur., 700 ft. S of N line, 1,250 ft. E of W line of tract ..... Drlg. sand 900 ft.
Humble O. & R. Co.'s No. 16-B Lockwood & Sharp, John Rabb Sur., 2,372 ft. W of E line, 376 ft. N of S line, No. 1 tract ..... Drlg. shale 3,440 ft.
Humble O. & R. Co.'s No. 17-B Lockwood & Sharp, 2,372 ft. N of E line, 1,129 ft. N of S line of L. & S. No. 1-A tract ..... Set screen 5,262 ft.
Humble O. & R. Co.'s No. 21 Lockwood & Sharp, John Rabb Sur. ..... Spudding.
Humble O. & R. Co.'s No. 24-A Lockwood & Sharp .... Comp. 50 bbls. per hour; ⅝-in. choke; T.D. 5,300 ft.
Texas Co.'s No. 5 Waters, 300 ft. S, 300 ft. W from NE cor. of lease ..... Drlg. shale 5,274 ft.
West-Lan Oil Co.'s No. 1 Mulahill, 300 ft. N of S line, 300 ft. W of E line ..... Drlg. shale 5,426 ft.

ORCHARD—FORT BEND COUNTY

Gulf Prod. Co.'s No. 37 J. M. Moore, 4,842 ft. W line of J. Frazier Sur., 375 ft. E at right angles to lease .. Drlg. gumbo 855 ft.

SUGARLAND—FORT BEND COUNTY

Dewalt Oil Co.'s No. 1 Peterson ..... No report.

HIGH ISLAND—GALVERTON COUNTY

Yount Lee Oil Co.'s No. 2 Broussard-Orme, Martin Dunman Sur., 300 ft. S of No. 1-B Cade ..... Drlg. shale 2,220 ft.
Yount Lee Oil Co.'s No. 33 Cade, 600 ft. NW of No. 1-B Cade, 755 ft. from No. 1 Smith, N. Fitzsimmons Sur. ..... Drlg. shale 2,569 ft.
Yount Lee Oil Co.'s No. 37 Cade, N. Fitzsimmons Sur., 600 ft. S of No. 36 ..... Drlg. sand 4,498 ft.
Yount Lee Oil Co.'s No. 1-B Cade, N. Fitzsimmons Sur., 488 ft. from S line, 320 ft. from E line ..... Cmtd. 5,910 ft.
Yount Lee Oil Co.'s No. 1-B Smith ..... Drlg. sand 4,025 ft.
Yount Lee Oil Co.'s No. 19 Smith, Martin Dunman Sur., 150 ft. N at right angles from center of line between 14 and 15 ..... Drlg. sand 3,030 ft.

ARRIOLA—HARDIN COUNTY

Republic-Houston Oil Co.'s No. 5 Arriola, 400 ft. NE of No. 4 Arriola, Arriola Sur. ..... Rigging.

SARATOGA—HARDIN COUNTY

Rio Bravo Oil Co.'s No. 102 Jordit, Jordit Sur. ..... Drlg. shale 1,001 ft.

SOUR LAKE—HARDIN COUNTY

Arlis Pet. Co.'s No. 1 Sour Lake Bank, H.&T.C. Sur., NW cor. Blk. 11, Sec. 69 ..... T.D. 2,050 ft.; standing.
Sesmo Oil Co.'s No. 1 W. R. Sasewell, 940 ft. S of NW cor., and 600 ft. from E line, B.B.B.&C. Sur. ..... Derrick.

GOOSE CREEK—HARRIS COUNTY

Gulf Prod. Co.'s No. 17-A Tabb, Wm. Scott Sur., 1,288 ft. N line, 50 ft. E line (W.O.) ..... Sand 3,313 ft.; S.O.
Smith-Faust's No. 1 Washington-Texas Prod. Co., Wm. Scott Sur., 200 ft. W of E line, 75 ft. S of N line, 2 acres ..... Drlg. 2,070 ft.

HUMBLE—HARRIS COUNTY

Texas Co.'s No. 24 Koehler (O.W.D.D.) ..... Swabbing 62 bbls. daily net oil; 3,310 ft.
Wilson Pet. Co.'s No. 1 Cicero (W.O.) ..... Drlg. 3,450 ft.

MYKAWA—HARRIS COUNTY

Crown-Framer Oil Co.'s No. 4 Minnetex, 165 ft. S, 120 ft. W, of NE cor. Blk. 193, Wm. Lovett Sur. (W.O.) Drlg. shale 6,636 ft.

PIERCE JUNCTION—HARRIS COUNTY

White & Ward's No. 1 Bullock ..... Standing 4,005 ft.

TOMBALL—HARRIS COUNTY

Amerada Pet. Corp. et al's No. 1 Fletcher, J. House Sur., 163 ft. N line, 1,852 ft. S line of lease ..... Rigging.
Humble O. & R. Co.'s No. 2 Bloecher, C. Goodrich Sur., center of 17-ac. tract ..... Drlg. shale 6,007 ft.
Humble Oil & R. Co.'s No. 1 Fredericks, center 18-ac. tract, J. M. Hooper Sur. ..... T.D. 5,594 ft.; comp. 21 bbls. an hr.; ½-in. choke.
Humble O. & R. Co.'s No. 1-B Kobs, 1,399 ft. W of E line, 466 ft. N of S line, J. H. Edwards Sur. ..... Drlg. shale 4,841 ft.
Humble O. & R. Co.'s No. 1 Petrick, J. M. Hooper Sur., 600 ft. N line, 466 ft. E line of lease ..... Derrick.
Humble O. & R. Co.'s No. 1 Quilter, A. Senchel Sur., 1,320 ft. out of NE cor. 320-ac. tract ..... Spudded.
Humble O. & R. Co.'s No. 1 Theis, 600 ft. N of S line, 500 ft. E of W line, 100-ac. tract, C. Goodrich Sur.. Sand 5,580 ft.; setting screen to test.
Magnolia Pet. Co.'s No. 1 Ervine, J. House Sur., 1,178 ft. E line, 1,399 ft. S line of lease ..... Drlg. shale 3,505 ft.
Magnolia Pet. Co.'s No. 1 Rudel-Oster, J. House Sur., 3,664 ft. S line, 162 ft. W line ..... Drlg. shale 4,510 ft.
Texas Co.'s No. 1 H. Martens, C. Goodrich Sur., 466 ft. W, 300 ft. N of SE cor. of lease ..... T.D. 5,576 ft.; comp. 40 bbls. a day; ½-in. choke.
Texas Co.'s No. 1 Hirsh, J. House Sur., 466 ft. N, 500 ft. E of SW cor. of 61-ac. tract ..... Rigging.
Texas Co.'s No. 1 Scherer, J. House Sur., 410 ft. E, 466 ft. N of SE cor. ..... Derrick.

FANNETT—JEFFERSON COUNTY

Black Gold Oil Co.'s No. 1 Jackson, Wm. Smith Sur., 3,766 ft. S line, 117 ft. from W line (356) ..... Drlg. shale 4,475 ft.
Gulf Prod. Co.'s No. 7 Burrell, W. H. Smith Sur., 150 ft. W of No. 6 ..... Made 545 bbls. oil in 14 hrs.; T.D. 3,261 ft.

ESPERSON—LIBERTY COUNTY

Cranfill-Reynolds Co.'s No. 7 Davis (W.O.), Duncan Sur.. Drlg. shale 7,170 ft.
Cranfill-Reynolds Co.'s No. 11 Moores Bluff, Duncan Sur., 2,100 ft. from N line, 1,069 ft. from E line of 632-ac. tract ..... Drlg. shale 4,660 ft.

HANKAMER—LIBERTY COUNTY

Gulf Prod. Co.'s No. 2 Crowe & Jacobs, 1,700 ft. E, 1,050 ft. N of SW cor. of H.&T.C. Sur. No. 21 ..... T.D. 6,560 ft.; sidetracked and drlg. new hole 3,700 ft.

HULL—LIBERTY COUNTY

Eclipse Oil Co.'s No. 1 Ward, (W.O.) Jesse Devore Sur., 50 ft. S, 50 ft. W of NE cor. Empire G. & F. Co.'s 13 acres ..... Drlg. shale 5,543 ft.
W. B. Flynn's No. 2 Flynn, J. Devore Sur., 25 ft. S No. 1. T.D. 1,546 ft.; fishing.
Hannah Oil Co.'s No. 1 Hannah, J. Devore Sur. (W.O.).. Rigging.
Hannah Oil Co.'s No. 2 Hannah, J. Devore Sur. ..... Derrick.
Houston Prod. Co.'s No. 3 Orgain, J. Devore Sur., 50 ft. from N and W lines of lease ..... Drlg. gumbo 375 ft.
Houston Prod. Co.'s No. 2 Orgain, 300 ft. E of No 1 .. Drlg. shale 3,000 ft.
Humble O. & R. Co.'s No. 27 Hooks-Guedry, Jesse Devore Sur. ..... Drlg. shale 608 ft.
H. Mecom's No. 1 Piggott, 450 ft. W line, 110 ft. N of H. L. Mecom et al's No. 1 Barrows, J. Devore Sur., 50 ft. N of CSL of strip on 3-ac. tract ..... Rigging.
Miramar Oil Corp.'s No. 1-B Phoenix, J. Devore Sur., 155 ft. from N line, 700 ft. from W line of lease .. Rig.
Miramar Oil Corp.'s No. 4 Phoenix, 75 ft. N, 37 ft. E from NW cor. of Houston Prod. Co.'s Orgain lease.. Drlg. shale 1,565 ft.
Miramar Oil Corp.'s No. 5 Phoenix Dev. Co., J. Devore Sur., 50 ft. from NW cor. of 25-ac. lease ..... Rigging.
Miramar Oil Corp.'s No. 3 Phoenix Dev. Co., Jesse Devore Sur., 400 ft. due E of No. 1 Phoenix Dev. .... Sand 4,632 ft.; drlg. plug.
Republic Prod. Co.'s No. 149 Dolbear (W.O.), Jesse Devore Sur., 250 ft. W of No. 6 ..... Comp. 100 bbls.; T.D. 2,912 ft.
The Texas Co.'s No. 8 Hannah (W.O.), Jesse DeVore Sur. ..... T.D. 5,376 ft.; reaming 4,575 ft.

LIBERTY FIELD—LIBERTY COUNTY

H. Mecon's No. 1 Piggott, 450 ft. W line, 110 ft. N of S line of 5-ac. tract, N. G. White Sur. ..... Comp. 200 bbls. daily; 3,690 ft.
Rose Oil Co.'s No. 1 Richardson, M. G. White Sur., 120 ft. E of Gulf-Humble's No. 1 Carter ..... Derrick.

CONROE—MONTGOMERY COUNTY

Alpha Pet. Co.'s No. 1 Texas Dev. Co. ..... Drlg. shale 4,000 ft.
Brown & Wheeler's No. 1 Gilbert, J. A. Davis Sur., 1,050 ft. S, 4,327 ft. W of lease ..... Drlg. shale 4,877 ft.
Feltex Oil Co.'s No. 3 Kirby-Bertrand, Wagers Sur., 1,267 ft. S of No. 1, center E and W of tract ..... Drlg. shale 4,727 ft.
Gulf Coast Drlg. & Prod. Co.'s No. 2 J. L. Hensley, A. Steele Sur., 466 ft. S line in center E and W of strip ..... Derrick.
Gulf Coast Drlg. & Prod. Co.'s No. 11 Keystone Mills.. Comp. 158 bbls. a day; T.D. 5,069 ft.
Gulf Coast Drlg. & Prod. Co.'s No. 12 Keystone Mills, A. James Sur., 467 ft. W line, 933 ft. S of No. 11.. Derrick.
Gulf Coast Drlg. & Prod. Co.'s No. 12-B Keystone Mills ..... Drlg. 5,043 ft.

Gulf Oil & Sulphur Co.'s No. 2 Springfield, J. S. Springfield Sur., 466 ft. from SW line, 100-ac. lease ..... Derrick.
Humble O. & R. Co.'s No. 3-B Cartwright, J. R. Davis Sur., S offset to Brown & Wheeler's No. 1 Gilbert... Drlg. shale 1,924 ft.
Humble O. & R. Co.'s No. 3 P. Collins, 1,050 ft. N of S line, center E and W, 75-ac. tract, L. Smith Sur... Drlg. shale 4,810 ft.
Humble O. & R. Co.'s No. 6 Hirsch, D. McIntyre Sur., 466 ft. N line, 330 ft. E line of survey ..... Drlg. shale 953 ft.
Humble O. & R. Co.'s No. 4 D. P. Griffin, 330 ft. W of E line, 108 ft. N of S line of tract, Wilson Strickland Sur. ..... Drlg. shale 4,210 ft.
Humble O. & R. Co.'s No. 13 Madeley, Ransom House Sur., 800 ft. N line, 1,310 ft. W line of tract ..... Comp. 63 bbls. per hour; ½-in. choke, 5,156 ft.
Humble O. & R. Co.'s No. 19 Madeley, Ransom House Sur. ..... Drlg. shale 2,782 ft.
Humble O. & R. Co.'s No. 25 Madeley, Ransom House Sur., 933 ft. S of No. 15 ..... Sand 5,137 ft.; cmtd. csg.
Humble O. & R. Co.'s No. 4 L. B. McComb, 1,134 ft. NW, 873 ft. NE at right angles out of SW cor. of L. Smith Sur. ..... Drlg. shale 3,611 ft.
Humble O. & R. Co.'s No. 22 Moore, L. Smith, 933 ft. SW of No. 21 ..... Drlg. shale 4,780 ft.
Humble O. & R. Co.'s No. 31 Moore, L. Smith Sur., 933 ft. SW of No. 16 ..... Drlg. lime 3,837 ft.
Humble O. & R. Co.'s No. 39 Moore, L. Smith Sur., 933 ft. SW of No. 38 ..... Drlg. sand 5,095 ft.
Humble O. & R. Co.'s No. 48 South Texas Dev. Co., Theo. Slade Sur., 951 ft. SE of No. 1, 951 ft. NE of No. 7 ..... Comp. 78 bbls. per hour; ½-in. choke, 5,163 ft.
Humble O. & R. Co.'s No. 49 South Tex. Dev. Co., Theo. Slade Sur., 950 ft. E of No. 47 ..... Drlg. shale 961 ft.
Humble O. & R. Co.'s No. 50 South Tex. Dev. Co., 950 ft. E of No. 49, Theo. Slade Sur. ..... Drlg. shale 960 ft.
Humble O. & R. Co.'s No. 51 South Tex. Dev. Co., Theo. Slade Sur. ..... Comp. 82 bbls. per hour; ½-in. choke, 5,157 ft.
Humble O. & R. Co.'s No. 53 South Tex. Dev. Co., 700 ft. NE of No. 49, Theo. Slade Sur. ..... Rigging.
Humble O. & R. Co.'s No. 2-D South Tex. Dev. Co. ..... Drlg. shale 4,993 ft.
Humble O. & R. Co.'s No. 1-B Williams ..... Comp. 61 bbls. per hour; ½-in. choke, 5,141 ft.
Moore & Bruton's No. 3 W. N. Hooper, I.&G.N. No. 11 Sur., midway between Nos. 1 and 2 ..... Drlg. shale 4,438 ft.
Strake Pet. Corp.'s No. 2 Etheridge, S. H. Bryan Sur., 467 ft. E line, 3,350 ft. S line lease ..... Comp. 95 bbls. per hour; ½-in. choke, 5,118 ft.
Strake Pet., Inc.'s No. 1 Krohn, 466 ft. E line, 330 ft. N line, S. H. Bryan Sur. ..... Drlg. shale 3,874 ft.
Strake Pet., Inc.'s No. 2 Krohn, Stephen Bryan Sur. ... No report.
Strake Pet., Inc.'s No. 3 Krohn, 880 ft. S of No. 1, S. H. Bryan Sur. ..... Derrick.
Sun Oil Co.'s No. 21 Foster, J. Bricker Sur. ..... Rigging.
Sun Oil Co.'s No. 25 Foster, J. Bricker Sur. ..... Rigging.
Sun Oil Co.'s No. 33 Foster, J. Bricker Sur., 1,358 ft. S, 1,613 ft. E of lease and survey line ..... Shale 5,146 ft.
Sun Oil Co.'s No. 6 Keystone Mills, 1,057 ft. S of No. 5 and 875 ft. W of No. 2 ..... Drlg. shale 3,289 ft.
Sun Oil Co.'s No. 7 Keystone Mills, A. Steele Sur., 1,000 ft. S of No. 6 and 877 ft. W of No. 3 ..... Spudding.
Sun Oil Co.'s No. 9 Keystone Mills, A. Steele Sur., 437 ft. S of N line, 906 ft. W of No. 5 ..... Drlg. shale 2,110 ft.
Sun Oil Co.'s No. 10 Keystone Mills, A. Steele Sur. .... Derrick.
Texas Unity Oil Co.'s No. 1 Keystone Mills ..... Drlg. sand 5,100 ft.
West Prod. Co.'s No. 1 Foster Lbr. Co., 467 ft. N line, 650 ft. W line, Sec. 3, T.&N.O. Sur. ..... T.D. 5,565 ft.; P.B. to 5,135 ft.; cmtd. csg.

ORANGE—ORANGE COUNTY

Gulf Prod. Co.'s No. 12 Hager-Moore (W.O.) ..... Drlg. sand showing oil 4,265 ft.

PORT NECHES—ORANGE COUNTY

Texas Co.'s No. 1-B Polk, Jacob Beaumont Sur., 150 ft. NE cor. ..... Drlg. gumbo 3,251 ft.
Texas Co.'s No. 2-B Polk, 695 ft. N, 150 ft. S of NE cor. of N. Jacob Beaumont Sur. ..... Reaming to straighten hole, 1,266 ft.
Texas Co.'s No. 4 Kuhn, 150 ft. E, 150 ft. N of NW cor. of lease ..... Drlg. sand 1,133 ft.

LIVINGSTON—POLK COUNTY

Vick Borsodi et al's No. 1 West, E 3½ acres of 35 acres, Roberts tract, A. Viesca Sur. ..... Cmtd. csg. 4,320 ft.
Gist Oil Co.'s No. 1 Kingsbury County Holding Corp., A. Viesca Sur., 150 ft. N at right angles and 193 ft. E along S line of tract ..... Derrick.
Humble O. & R. Co.'s No. 1 Grandbury, 1,320 ft. N, center E and W of 50-ac. tract ..... Drlg. sand 4,320 ft.
Polk County Drlg. Co.'s No. 1 Cooper, 330 ft. S, 200 ft. E, NW cor. 12½ acres, A. Viesca Sur. ..... Drlg. shale 3,746 ft.
Shell Pet. Corp.'s No. 2 Davis & Holmes, A. Viesca Sur., 485 ft. N, 376 ft. W of NE cor. of Jim Duff 35-ac. tract ..... T.D. 4,400 ft.; resetting screen.
Shell Pet. Corp.'s No. 3 Davis-Holmes, M. C. Swinney Sur., 577 ft. NE of center of SW line ..... Moving in material.
Skelly Oil Co.'s No. 1 Sanders, 755 ft. N of E line, 305 ft. S of N line, Sanders' 40 acres, A. Viesca Sur. ..... T.D. 4,322 ft.; setting screen.

GRETA—REFUGIO COUNTY

Atlantic-Alamo Oil Co.'s No. 2 J. J. O'Brien, M. J. Ximines Sur. ..... Spudding.
Atlantic and Alamo Oil Co.'s No. 1-E J. M. O'Brien, 340 ft. S line, 466 ft. E line ..... Comp. 460 bbls.; ¼-in. choke, 4,394 ft.
Atlantic-Alamo's No. 2-E O'Brien, 933 ft. N of No. 1, 466 ft. E line ..... Rigging.
Atlantic-Alamo's No. 3-E O'Brien, 933 ft. from No. 2, 466 ft. E line ..... Drlg. shale 3,440 ft.
Atlantic-Alamo's No. 5-E O'Brien, 933 ft. N of No. 4, 312 ft. E line ..... Sand 4,407 ft.; made 84 bbls. in 7 hrs.
Atlantic Oil Prod. Co.'s No. 2-C O'Brien, 1,992 ft. N of No. 1 ..... Drlg. shale 3,600 ft.
Atlantic Oil Prod. Co.'s No. 3-C O'Brien, 2,788 ft. S of W line, 625 ft. W of E line ..... Cmtd. csg. 4,365 ft.
Atlantic Oil Prod. Co.'s No. 4-C O'Brien, 466 ft. out of NE cor. ..... Drlg. sand 3,493 ft.
Atlantic Oil Prod. Co.'s No. 5-C O'Brien, 1,193 ft. S of N line, 638 ft. E line ..... Drlg. lime 1,360 ft.
Atlantic Oil Prod. Co. and Heyser & Heard's No. 2 O'Brien ..... Drlg. sand 3,398 ft.
Circle W Oil Co.'s No. 4 O'Brien, 795 ft. S of No. 3, 466 ft. E line ..... Comp. 600 bbls.; ¼-in. choke, 4,400 ft.
Circle W Oil Co.'s No. 7 J. M. O'Brien, 916 ft. N of No. 8, E. H. Winfield Sur. ..... Drlg. shale 1,147 ft.
Circle W Oil Co.'s No. 8 J. M. O'Brien, 1,008 ft. N of No. 9, E. H. Winfield Sur. ..... Drlg. clay 277 ft.
Dash Prod. Co.'s No. 1 E. J. J. O'Brien, 466 ft. S of N line, center E and W of tract, N. S. Crunk Sur. .. Drlg. shale 4,184 ft.
Dash Prod. Co.'s No. 3 O'Brien, N. S. Crunk Sur., 646 ft. of W line, 301 ft. at right angles R.R. ..... T.D. 4,400 ft.; S.O.; washing in.
Floboots Oil Corp.'s No. 1 J. J. O'Brien, 466 ft. S of N line, 466 ft. E line, 50-ac. tract, N. S. Crunk Sur... Rigging.
Floboots Oil Corp.'s No. 2-C O'Brien, 466 ft. out of SW cor. Lot 12 ..... Drlg. shale 4,369 ft.
Floboots Oil Corp.'s No. 1-B O'Brien, 466 ft. out of SW cor. ..... Comp. 200 bbls.; 1/16-in. choke, 4,374 ft.
G. L. Gray Oil Corp.'s No. 1 F. Heard, 466 ft. E of W line, 466 ft. S of N line of NW 40-ac. tract out of Heard's 377-ac. tract ..... Drlg. shale 1,284 ft.
Greta Oil Corp.'s No. 1-C O'Brien, 250 ft. S line, 150 ft. E at right angles to highway ..... Drlg. lime 4,062 ft.
Greta Oil Corp.'s No. 2-C O'Brien, 250 ft. N line and 150 ft. E line at right angles to highway, Winfield Sur. ..... Drlg. shale 4,374 ft.
Greta Oil Corp.'s No. 5-B O'Brien, 466 ft. out of SW cor. of tract, E. Winfield Sur. ..... Drlg. shale 1,323 ft.
Hewitt & Daugherty's No. 1 M. F. Lambert, 2,530 ft. E of NW cor., Harper Sur., 466 ft. S in Hardwick Sur. ..... Rigging.
Humble O. & R. Co.'s No. 1 F. Heard, 466 ft. out of NW cor. Ximines Sur. ..... Drlg. 1,438 ft.
Edwin M. Jones No. 2 O'Brien, E. H. Winfield Sur., Blk. 4, 466 ft. from N line in center E and W ..... Drlg. shale 4,383 ft.
Edwin M. Jones' No. 3-G O'Brien ..... Derrick.
Nesral Oil Co.'s No. 1 Ira Heard, M. J. Ximines Sur., 330 ft. out of NW cor. of 25-ac. tract ..... Drlg. shale 5,595 ft.
Nesral Oil Co.'s No. 2 O'Connor, 1,586 ft. SE of No. 1 and 466 ft. W of E line (R/A to EL) ..... Comp. 220 bbls.; ¼-in. choke, 4,370 ft.
Nesral Oil Co.'s No. 4 O'Connor ..... Derrick.
Nesral Oil Co.'s No. 5 O'Connor ..... Drlg. shale 1,298 ft.
Rutherford and Atlantic's No. 2-B O'Brien ..... Drlg. sand 4,381 ft.
Southwest Pet. Corp.'s No. 2-A O'Brien, E. H. Winfield Sur., 466 ft. NW cor. 25-ac. tract ..... Cmtd. 7-in. csg. 4,350 ft.
Southwest Oil Corp.'s No. 3-B J. M. O'Brien, N. Crunk Sur., east offset United's No. 8 Fox ..... Rigging.
Southwest Oil Corp.'s No. 1-D J. M. O'Brieen, 466 ft. out of NW cor. of 26-ac. tract, N. S. Crunk Sur. ... Drlg. shale 4,350 ft.
Texas Gulf Prod. Co.'s No. 2 J. M. O'Brien, J. A. Peoples Sur., 466 ft. NW cor., Blk. 3 ..... Drlg. shale 1,380 ft.
Texas Gulf Prod. Co.'s No. 1 J. M. O'Brien, J. H. Winfield Sur., 466 ft. NS line, center E and W, Blk. 12 ..... Moving in material.
United Prod. Co.'s No. 6 Fox est., Wm. Hews and L. Brown Sur., 2,956 ft. N line, 787 ft. E line ..... T.D. 4,390 ft.; flowing by gas 100 bbls. daily.
United Prod. Co.'s No. 7 W. T. Fox, 695 ft. SE of No. 6, Hews & Brown Sur. ..... Drlg. shale 3,003 ft.
United Prod. Co.'s No. 8 Fox est., 1,473 ft. N, 466 ft. E of SE cor. N. S. Cronk Sur. ..... Showing oil and wtr. 4,399-4,403 ft.
United Prod. Co.'s No. 9 Fox, 880 ft. NE of No. 6, Hews & Brown Sur. ..... Drlg. shale 2,967 ft.
United Prod. Co.'s No. 10 Fox, 894 ft. NE of No. 9, Hews & Brown Sur. ..... Derrick.
United Prod. Co.'s No. 11 Fox, 867 ft. NE of No. 10, Hews & Brown Sur. ..... Derrick.

CLAY CREEK—WASHINGTON COUNTY

Sun Oil Co.'s No. 9 Clay, 600 ft. NE of No. 1 Clay, J. F. Perry Sur., 757-ac. tract ..... Drlg. shale 2,427 ft.

BOLING—WHARTON COUNTY

Asher et al's No. 2 Rogers, S. F. Austin Sur., 685 ft. NE, 115 ft. NW of S cor. W. G. Reagin & Son's tract Standing 1,215 ft.

SOUTH LOUISIANA FIELDS

ASSUMPTION PARISH

Barnsdall Oil Co.'s No. 1 Williams, 330 ft. out of NE cor. Sec. 33-14s-14e ..... Drlg. shale 7,545 ft.

DARROW—ASCENSION PARISH

Gulf Ref. Co.'s No. 1 Darrow Community, 600 ft. due N, 100 ft. due W of Rio Bravo's No. 1 Community .... Moving in.

VINTON—CALCASIEU PARISH

Starks & Broker's No. 11 A. J. Vincent, NW cor. SE Sec. 33-10s-12w ..... Moving in material.
Wilson Broach's No. 4 Wilson ..... Standing 3,806 ft.
Wilson Broach's No. 10 Wilson Strip, 650 ft. N, 379 ft. E. SW cor. SE NE Sec. 33-10S-12w ..... Derrick.
Gulf Ref. Co.'s No. 7 J. W. Gardner, 308 ft. E, 550 ft. N, SW cor. SE NE Sec. 33-10s-12w ..... Drlg. shale 4,370 ft.
Vinton Pet. Co.'s No. 1 Vincent ..... Drlg. sand 1,009 ft.
Vinton Pet. Co.'s No. 22 Vincent, 685 ft. N, 620 ft. E of SW cor. Sec. 34-10s-12w ..... Standing 2,774 ft.

CAMERON MEADOWS—CAMERON PARISH

Humble O. & R. Co.'s No. 4 Cameron Meadows, 360 ft. N, 600 ft. W, SE cor. Sec. 21-14s-13w ..... Drlg. clay 198 ft.

CALCASIEU PARISH

Gulf Ref. Co.'s No. 1 Sweet Lake Oil Co., 660 ft. N, 330 ft. E of SW cor. Sec. 29-10s-5w ..... Rigging.
Fred Oil Co.'s No. 1 Farszt, 566 ft. N, 300 ft. W, SE cor. NW SE Sec. 26-8s-10w ..... Standing.
Union Sulphur Co.'s No. 1 Barbe, 2,661 ft. W, 2,647 ft. S of NE cor. Sec. 1-9s-8w ..... Rigging.

CHOCTAW—IBERVILLE PARISH

Standard Oil Co. of La.'s No. 5 Myrtle Grove, 1,700 ft. N, 200 ft. W, SE SW cor. SW Sec. 52-9s-11e ..... Drlg. shale 972 ft.

EDGERLY—CALCASIEU PARISH

S. A. Emerson's No. 13 Hunter, 465 ft. N, 90 ft. E. SW cor. Sec. 21-9s-11w (W.O.) ..... Rigging up to deepen 4,118 ft.

GUEYDAN—VERMILLION PARISH

Pure Oil Co.'s No. 1 Grady Lee-Humble, 2,031 ft. E. 225 ft. N of NW cor. Sec. 34, in Sec. 27-11s-1w.... Drlg. sand 3,912 ft.
Pure Oil Co.'s No. 4 Mulvey, 1,721 ft. from N line, 2,515 ft. from W line of Sec. 34-11s-1w ..... Abd. 4,801 ft.

LAFOURCHE PARISH

Gulf Ref. Co.'s No. 1-B Community, 1,685 ft. E, 365 ft. NW Sec. 26-21s-22e ..... Drlg. sand 3,803 ft.
Barnsdall Oil Co.'s No. 1 Harang, Lot 4, in Twp. 17s-20e. Drlg. shale 6,398 ft.

LAKE BARRE—TERREBONNE PARISH

Texas Co.'s No. 9 Lake Barre-L.L.&E., 4,013 ft. S, 305 ft. E of NW cor. Sec. 30-21s-20e in Sec. 36-21s-19e ..... Drlg. anhydrite 3,506 ft.
Texas Co.'s No. 22 State-Lake Barre, 150 ft. northerly from No. 18 ..... Drlg. lime and shale 4,364 ft.

LAKE WASHINGTON—PLAQUEMINES PARISH

Humble O. & R. Co.'s No. 11 Cockrell & Moran ..... Gumbo 400 ft.; standing.
Humble O. & R. Co.'s No. 12 Cockrell & Moran ..... Standing 1,169 ft.
Humble O. & R. Co.'s No. 3 La. State, Twp. 20s-26e, 2,920 ft. N, 19 ft. E of station ..... Drlg. sand 3,188 ft.

LOCKPORT—CALCASIEU PARISH

Magnolia's No. 9 Farquaher, 200 ft. N. 150 ft. E of SW cor. NE SE Sec. 8-10s-9w (O.W.D.D.) ..... Drlg. sand 5,684 ft.
Magnolia Pet. Co.'s No. 4-A Watkins fee, 685 ft. E, 200 ft. N of SW cor. NW NE Sec. 9-10s-9w ..... Drlg. sand 3,801 ft.
Union Sulphur Co.'s No. 1 Moss (W.O.) ..... Drlg. shale 4,127 ft.

HACKBERRY—CAMERON PARISH

Gulf Ref. Co.'s No. 12 Irwin, 685 ft. N, 518 ft. E of SW cor. Sec. 44-12s-9w ..... Drlg. shale 7,386 ft.
Pop Oil Co.'s No. 1 Yount Lee, 3,996 ft. W, 100 ft. N of SE cor. Sec. 19-12-10w ..... Cmtd. csg. 3,922 ft.

IOWA—CALCASIEU AND JEFF DAVIS PARISHES

Barnsdall Oil Co.'s No. 1 Heyd, 330 ft. SW cor. of E½ SW Sec. 7-9s-6w ..... Drlg. shale 6,239 ft.
Magnolia Pet. Co.'s No. 2 Willett, 990 ft. N, 330 ft. E of SW cor. NW Sec. 7-9s-6w ..... Dry and abd. 7,194 ft.
Shell Pet. Corp.'s No. 5 Heyd, 325 ft. S of NW cor. of Sec. 18-9s-7w, and 225 ft. W of E line of Sec. 13.. Drlg. sand 6,355 ft.
Shell Pet. Corp.'s No. 6 Heyd, 660 ft. S line, 660 ft. W line of lease, Sec. 18-9s-7w ..... Comp. 530 bbls.; 21/64-in. choke, 4,470 ft.
Shell Pet. Corp.'s No. 1 Tuten, 265 ft. S, 330 ft. W of NE cor. SW Sec. 13-9s-7w ..... Temp. S.D. 1,337 ft.

JEFFERSON DAVIS PARISH

Humble O. & R. Co.'s No. 2 Devilbiss, 1,850 ft. S, 350 ft. W of NE cor. Sec. 14-9s-4w ..... T.D. 7,343 ft.; sidetracked 6,743 ft.; drlg. new hole 6,871 ft.

JENNINGS—ACADIA PARISH

Yount Lee Oil Co.'s No. 13 Houssiere-Latrielle, Sec. 47-9s-2w, 300 ft. E of No. 12 ..... Drlg. anhydrite 5,200 ft.

EAST BATON ROUGE PARISH

British-American Oil Co.'s No. 1 Louisiana, 2,750 ft. NE NW cor. Sec. 79, and 1,700 ft. N of NE Sec. 79, in Sec. 6-8s-1e ..... Fishing D.S. stuck at 4,444 ft.

LEESVILLE—LA FOURCHE PARISH

Texas Co.'s No. 7 L.L.E., 2,921 ft. S, 300 ft. W of NE cor. Sec. 27-21s-22e ..... Comp. 1,657 bbls.; ½-in. choke, 2,629 ft.

PORT BARRE—ST. LANDRY PARISH

Cale O. & G. Co.'s No. 1 Thompson ..... Drlg. shale 3,181 ft.
Campbell et al's No. 1 J. E. Jeonsonne, Sec. 7-4s-5e, 30 ft. N of S line in center E and W of 30-ac. tract.. Cmtd. csg. 3,825 ft.
Texas Co.'s No. 17 Botney Bay, 1,300 ft. S 8 deg. W, 600 ft. N 82 deg. most southern NE 560 deg. tract, Sec. 4-4s-5e ..... Derrick.
Texas Co.'s No. 18 Botney Bay ..... Drlg. sand 3,308 ft.

PLAQUEMINES PARISH

Southern Sulphur Co.'s No. 1 Bay Adams ..... Rig.
Texas Co.'s No. 9 Garden Island Bay, 4,791 ft. S, 2,504 ft. W of NE cor. Sec. 104-23s-32e ..... Abd. in salt 2,155 ft.

SORRENTO—ASCENSION PARISH

Union Sulphur Co.'s No. 25 United Land ..... Rigging.

STARKS—CALCASIEU PARISH

Gulf Ref. Co.'s No. 11 Lutcher-Moore (D.D.), 1,370 ft. W, 885 ft. N of SE cor. NE Sec. 19-9s-12w..... Abd. 4,497 ft.
Union Sulphur Co.'s No. 3 Industrial Lbr. Co., 2,400 ft. N, 412 ft. W, SE cor. Sec. 19-9s-12w ..... Drlg. rock 3,573 ft.

SULPHUR—CALCASIEU PARISH

Union Sulphur Co.'s No. 779 fee, 1,153 ft. N, 795 ft. E of center of Sec. 29-9s-10 ..... Drlg. gumbo 2,228 ft.
Union Sulphur Co.'s No. 781 fee, 1,768 ft. W, 726 ft. N of C Sec. 29-9s-10w ..... Drlg. sand 3,068 ft.
Union Sulphur Co.'s No. 783 fee, Sec. 29-9s-10w ..... Salt 5,117-5,761 ft.; drlg. new hole 4,565 ft.
Union Sulphur Co.'s No. 786 fee ..... Drlg. gumbo 2,220 ft.

ST. BERNARD PARISH

Southern Sulphur Co.'s No. 1 Lake Lery, 400 ft. W, 500 ft. N, SW cor. Sec. 28-13s-15e ..... Cmtd. csg. 212 ft.
Southern Sulphur Co.'s No. 1 State Lake Bargne, 850 ft. N, 230 ft. E, SE cor. Sec. 33-13s-15e ..... Cmtd. csg. 650 ft.

ST. LANDRY PARISH

Gaunch Synd.'s No. 1 Lewis, 300 ft. N and E of SW cor. NW NE Sec. 29-5s-6e ..... Drlg. 111 ft.
H. H. Hotchins Lbr. Co.'s No. 1 Whiteman Lbr. Co., 250 ft. out of SW cor. NE Sec. 15-5s-6e ..... Cmtd. csg. 710 ft.

ST. MARTIN PARISH

Standard Oil Co. of Kansas' No. 1 E. B. Hopkins, Sec. 33-10s-6e ..... Cmtd. 6,010 ft.
Texas Co.'s No. 9 State-Dog Lake ..... Drlg. sand 723 ft.

TERREBONNE PARISH

Texas Co.'s No. 9 State-Caillou Island ..... Drlg. sand 788 ft.
Texas Co.'s No. 6 State Bay-St. Elaine, 700 ft. S of No. 3, Sec. 17-22s-18e ..... Dry and abd. 4,324 ft.
Texas Co.'s No. 1 School Board-Bay St. Elaine ..... Rigging.
Texas Co.'s No. 2 State-Four Isle ..... Moving in.
Texas Co.'s No. 1 State Bay-St. Elaine, 2,900 ft. N, 2,300 ft. E of SW cor. Sec. 3-22s-18e ..... Moving in.

VERNON PARISH

E. Dawson's No. 1 Delta Land & Timber Co., C SW SW Sec. 2-1n-11e ..... T.D. 2,820 ft.; sidetrack 2,615 ft. drlg. new hole, sand 2,730 ft.
R. E. Kay et al's No. 1 Willis, 350 ft. N, 400 ft. E, SW cor. SE SE Sec. 32-3-9w ..... Dry and abd. 3,962 ft.

WHITE CASTLE—IBERVILLE PARISH

Shell Pet. Corp.'s No. 7 Wilburn, 625 ft. N 60 deg. W, 1,165 ft. N 29 deg. E, SE of Lot 2, Sec. 9-11s-12e.. Drlg. shale 5,202 ft.

TEXAS

MISCELLANEOUS WILDCATS

AUSTIN COUNTY

R. R. Mitchell's No. 1 H. Schlerda, J. F. Fitzgibbons Sur., 300 ft. out NE cor. 96-ac. tract ..... Moving in material.

BRAZORIA COUNTY

Danciger O. & R. Co.'s No. 2 Hunt, 6,550 ft. E line, 5,550 ft. S line, W. Carson Sur. (W.O.) ..... T.D. 8,053 ft.; P.B. to 6,720 ft.; drlg. sand 6,820 ft.

BRAZOS COUNTY

H. Elliott et al's No. 1 W. F. Odom, near center of 379-ac. tract in SW cor. of Isack Curil Sur. ..... Rigging.
F. H. Scott's No. 1 Klintworth, I. Curd Sur., 300 ft. from N line, 400 ft. from E line ..... Reaming to set 1,390 ft. of 8-in. csg. to test gas at 1,393-1,415 ft.

CHAMBERS COUNTY

Mills & Jones' No. 1 Gau, J. S. Roberts Sur., 255 ft. W, 1,052 ft. S of NE cor. of 138-ac. tract (W.O.) ..... T.D. 5,626 ft.; sidetracked at 2,650 ft.; drlg. shale 3,900 ft.
Smith & Lavender's No. 1 McCormick, F. Ludlow Sur., 150 ft. NE cor. ..... Derrick.

COLORADO COUNTY

Columbus Dev. Co.'s No. 1 Miller, H.T.&B. No. 8, 2,268 ft. E of W line, 1,345 ft. S of N line of survey.. Drlg. shale 4,516 ft.
Humble O. & R. Co.'s No. 1-C Powell, I.&G.N.R.R. Sur., 1,086 ft. E, 578 ft. S of NW cor. Blk. 48..... Dry and abd. 6,282 ft.

FAYETTE COUNTY

Colorado Oil Corp., J. Winn Sur., 650 ft. NE of center of SW line of 63.8-ac. tract ..... Drlg. shale 1,760 ft.
Columbus Drlg. Co. and Gulf Prod. Co.'s No. 1 Turner, 400 ft. E of river, 300 ft. N of S line, J. Petty Sur... Cmtd. wtr. off 3,240 ft.

FORT BEND COUNTY

Pyramo Oil Corp.'s No. 1 M. T. Wood, T. Gleason Sur., center of 10-ac. tract (Blk. 474) ..... T.D. 5,082 ft.; washing to bottom.
A. N. Phillips et al's No. 1 Grigar, 2,150 varas E line, 1,550 varas N line, J. S. O'Connor Sur. ..... T.D. 700 ft.; standing.
Quintana Oil Co. and Great So. Life's No. 1 Great So. Life, E. Robertson Sur., 500 ft. S of N line, 500 ft. W of Brazos River ..... Drlg. shale 5,941 ft.

GRIMES COUNTY

Clark & Dodd's No. 1 Murry, 150 ft. W line, 300 ft. S line, Anderson Sur. ..... Spudded; standing.
Cambrian Oil Co.'s No. 1 W. V. Sangster, John Moore Sur., 300 ft. out of most westerly NW cor. of 218-ac. tract ..... Derrick.
Foster et al's No. 1 Quinn, 7,100 ft. from W line, 2,900 ft. from N line of S. F. Austin Sur. ..... Standing 65 ft.
Humble O. & R. Co.'s No. 1 Seaton, F. G. Seaton Sur., 260 ft. N and W, 71-ac. tract ..... Drlg. sand 3,540 ft.
H. C. Ratcliff's No. 1 Fulgham, A. Cutuli Sur., 1,000 ft. N line, 540 ft. W line of lease ..... Derrick.

HARRIS COUNTY

J. A. Hodges' No. 1 Scott, 200 ft. S, 900 ft. W of intersection of Crosby Huffman, F. Rankin Sur. ..... Drlg. sand 587 ft.
G. T. Lewis, tr.'s No. 1 Gore, S. McKissick Sur., 518 ft. SW along SE line of 100-ac. tract from W cor. of S. V. Allen's 105-ac. tract and 500 ft. NW at right angles in 100-ac. tract (W.O.) ..... Drlg. shale 4,550 ft.
Russell et al's No. 1 Burt & Griffith, S. Keely Sur., 200 ft. N line, 200 ft. E of highway ..... Drlg. gumbo 1,688 ft.
E. E. Young et al's No. 1 Paddock, J. Cunningham Sur., 300 ft. W of E line of Blk. 41 on line dividing Blks. 46 and 47 ..... Standing 630 ft.

JACKSON COUNTY

Continental Oil Co.'s No. 1 Vincek, V. Garcia Sur., 1,400 ft. W, 200 ft. N of SE cor. of Lot 17, Bennett Subd. ..... Dry and abd. 6,630 ft.
Ed Parsons et al's No. 1 Clark, 300 ft. out SW cor. of R. J. and M. Clark lease, A. S. White Sur. ..... Derrick.

JASPER COUNTY

Turnbull & Erwin's No. 1 Green, W. B. Green Sur., 269.3 varas S, 857 varas W of NE cor. ..... Drlg. sand 3,840 ft.

JEFFERSON COUNTY

Sun Oil Co.'s No. 1 Paggi, 990 ft. W, 1,610 ft. N of SE cor. of T.&N.O. Sur. No. 33 ..... Drlg. sandy shale 6,099 ft.
Texas Co.'s No. 1 J. R. Bevil, 150 ft. each way out of NE cor. of lease, Brown & Caswell Sur. ..... Drlg. gumbo 592 ft.

LEON COUNTY

Shell Pet. Corp.'s No. 1 A. Beggs, 406 ft. N, 1,128 ft. E of inside line of lease, John Carter Sur. ..... Sand showing gas and oil 5,723 ft.

LIBERTY COUNTY

W. W. Algren, tr.'s No. 1 Nona Mills Lbr. Co., J. E. Mayfield Sur., 400 ft. from W and 200 ft. from N line of lease ..... Drlg. gumbo 3,294 ft.
E. V. Parsons et al's No. 1 Foster Lbr. Co., Ann Holhausen Sur., 750 varas S line, 3,700 varas W of E line ..... Derrick.
Thomas et al's No. 1 A. Ercke, 600 ft. E of W line, 2,350 ft. N of S line, A. H. Ercke Sur. in Reason & Green Sur. ..... Drlg. shale 3,440 ft.

MATAGORDA COUNTY

Continental Oil Co.'s No. 1 Baker, 400 ft. out of SW cor. Lot 17, Robbins & Middle Subd., J. W. Criswell Sur. ..... Stuck D.S. in heaving shale 4,504 ft.; fishing at 5,200 ft.
Oils Consolidated, Inc.'s No. 1 Hawkins, Daniel McCarthy Sur., 1,240 ft. NE, 350 ft. NW of S cor. .... Rigging.
United North & South Dev. Co.'s No. 1 Unit 6 (No. 2 Stoddard), 25 ft. each way out of NW cor. of Lot 19, Buckeye Townsite ..... T.D. 7,872 ft.; P.B. to 5,500 ft.
United North & South Dev. Co.'s No. 1 Unit 25, 1,335 ft. S, 1,000 ft. E of No. 1 Unit 6 ..... Drlg. shale 7,862 ft.

MONTGOMERY COUNTY

Baker et al's No. 1 Benker, D. James Sur. ..... Drlg. shale 750 ft.
Gholson Bros.' No. 1 Crawford, 757 ft. due S from SE cor. of Mary Guber 48-ac. tract ..... Dry and abd. 4,487 ft.
L. C. Thorpe's No. 1 Sutherland, 2,450 ft. E line, 350 ft. N line of C McRay Sur. ..... T.D. 1,800 ft.; standing.
Stanolind O. & G. Co.'s No. 1 Theis, J. H. Edwards Sur., 466 ft. W line, 466 ft. S line ..... Cmtd. csg. 5,530 ft.; T.D. 5,541 ft.; S.O.

ORANGE COUNTY

Texas Louisiana Oil Co.'s No. 1 Starks, 2,450 ft. N of NW cor. M. Delano Sur. 68, 10,500 ft. E at right angles ..... Standing.

POLK COUNTY

D. B. McCall's No. 1 Faulkner, 350 ft. W of center of E line of 200-ac. tract, G. B. Dikes Sur. ..... Drlg. 495 ft.
Dick Schwab's No. 1 Kirby & West, Geraldus Thomas Sur., 1,000 ft. N of N line of P. A. Sublett Sur., and 2,000 ft. W of E line of Thomas Sur. ..... Fishing 4,771 ft.
C. E. Stewart's No. 1 Stephenson, E. Stevenson Sur. (Abst. 761), 1,622 ft. from N line, 920 ft. from W line of 217 acres ..... Rig.

REFUGIO COUNTY

C. B. Bunte et al's No. 1 F. B. Rooke, J. M. Aldritte Sur., CWL of Sec. 4 ..... Derrick.
Humble O. & R. Co.'s No. 10 O'Connor, Powers & Hewitson Sur., 15,133 ft. N of S line, 7,302 ft. W of E line, of J. Keating Sur. ..... Rigging.
Texas Co.'s No. 1 Rooke, J. M. Aldritte Sur., 7,500 ft. S 53 deg. W. 850 ft. 37 deg. W of N cor. Sur. .... Drlg. sandy shale 4,602 ft.
Wellington Oil Co.'s No. 1 Roach, R. J. Downey Sur., 1,250 ft. NW line, 515 ft. NE line of Tract No. 1.... Spudding.

TRINITY COUNTY

T. M. Smith et al's No. 1 C. Moody, E. Roberts Sur., 552 ft. W of E line, 1,202 ft. N of S line, of 40-ac. tract ..... Derrick.

VICTORIA COUNTY

J. F. Camp's No. 1 Maurer, 330 ft. NE cor. Maurer's 178 acres, R. Manchola Sur. ..... Drlg. shale 1,150 ft.
Stoneleigh O. & G. Co.'s No. 1 Dietzel, 330 ft. out of NW cor. of Dietzel's 95-ac. tract, R. Manchola Sur.. Rigging.
Stoneleigh O. & G. Co.'s No. 2 E. B. Terrell, 330 ft. out of SE cor. of Terrell's 215-ac. tract, R. Manchola Sur. ..... Moving in derrick.
Stoneleigh O. & G. Co.'s No. 1 Trybble, 330 ft. out of SE cor. Trybble's 122-ac. tract, R. Manchola Sur. .. Moving in derrick.
Stoneleigh O. & G. Co.'s No. 1 Zimmer, R. Manchola Sur., 1,007 ft. SW line, 645 ft. SE line ..... Drlg. shale 3,823 ft.
The Texas Co.'s No. 6-A McFaddin, 5,600 ft. from NE line, 250 ft. from SE line of A. J. Gray ..... Gas sand 3,039-49 ft.; pumping wtr. and mud into sand to kill pressure.
The Texas Co.'s No. 7 McFaddin, 6,400 ft. S 15 deg. W, 450 ft. N 75 deg. W at right angles from the NE cor. of the A. J. Gray Sur. ..... T.D. 1,176 ft; blowing gas and mud.
Texas Co.'s No. 7-A McFaddin, 250 ft. due N of No. 7, A. J. Gray Sur. ..... Rigging.
Texas Co.'s No. 8 McFaddin, A. J. Gray Sur., 6,600 ft. N of S line, 1,383 ft. from E line of NE cor. ..... Derrick.

WALKER COUNTY

McDowell et al's No. 1 Thompson, Jackson Crouch Sur., 330 ft. E of W line, 1,200 ft. S of N line .... Rigging.

WALLER COUNTY

Hobson & Moore's No. 1 Peters, Justo Liendo Sur., 590 ft. W of creek and 1,144 ft. N of S cor. ..... Drlg. shale 3,550 ft.

WHARTON COUNTY

Boggs & Hammond's No. 1 C. T. Kountze, Morris & Cummings Sur., 1,250 ft. S line, 2,750 ft. E line .... Drlg. shale 6,015 ft.
Monarch Oil Co.'s No. 1 Schatzek, 150 ft. each way out of SW cor. G. W. Reynolds Sur. ..... Derrick.
Nabers et al's No. 1 Lurker, 210 ft. out of SE cor. of N½ SW Sec. 58, E.T.R.R. Sur. ..... No report.
Pure Oil Co.'s No. 1 W. Garrett, Sec. 28, 4,456 ft. SE, 1,690 ft. NE of W cor. ..... T.D. 6,343 ft.; standing.
Pure Oil Co.'s No. 1 A. J. Wilder, T. W. Hurd Sur., 509, 2,575 ft. SE, 1,690 ft. NE from W cor. of Sec. 28. Drlg. sand and shale 6,302 ft.
Pure Oil Co.'s No. 1 Stewart, 2,419 ft. NW, 1,450 ft. NE of S cor. of Sec. 25, Morris & Cummings Sur. ..... T.D. 8,067 ft.; set whipstock 5,391 ft.
Pure Oil Co.'s No. 1 Chas. T. Kuntze, 2,183 ft. from NW line, 467 ft. from SW line, Sec. 27, Morris & Cummings Sur. ..... Fishing 7,134 ft.; a show at 7,138-34 ft.
Pure Oil Co.'s No. 1 W. H. Lancaster, Morris & Cummings Sur., Sec. 33, 1,650 ft. NW, 1,600 ft. SW of E cor. of section ..... Drlg. shale 5,588 ft.
Pure Oil Co.'s No. 1 Willis McIntyre, 1,650 ft. S of N line, 1,759 ft. S of E line of section ..... Drlg. sand 5,155 ft.
Pure Oil Co.'s No. 1 Wallace Houston, 858 ft. SE of NW line and 1,690 ft. NE of SW line, Sec. 28, (T. W. Heard Sur.) ..... Drlg. sand 5,519 ft.
Pure Oil Co.'s No. 1 Isaac Weaver, J. M. Brownson Sur., Sec. 22, 1,650 ft. out of N cor. of section .... T.D. 6,181 ft.; standing.
Smith, McDannald and Pure Oil Co.'s No. 1 B. M. Yeamans, 330 ft. out of N cor. of B. M. Yeamans Sur., Abst. 913 ..... Tested S.W. at 6,196 ft; standing.
Smith & McDannald and Shell Pet. Corp.'s No. 1 Ridgeway, 1,980 ft. from S, 660 ft. from W of NE cor. Sec. 8, H.&T.C. Sur. ..... T.D. 7,607 ft.; standing.

Wildcat Operations in Southwest Texas

(Continued from Page 117)

Isham et al's No. 1 Lester ranch, 200 varas from N and E lines of Antonio Bandrand Sur., 8 miles NE from Johnson City ..... T.D. 405 ft.; S.D.

CALDWELL COUNTY

Judge R. L. Batts' No. 2 Roebuck, 2,400 ft. from NE line, 1,300 ft. from SE line of tract in Arthur Swift Sur. ..... T.D. 2,320 ft.; drlg.
E. L. Hope and Joe Cole's No. 1 Mike August, 150 ft. from NE line, 165 ft. from NW line of tract ..... T.D. 1,961 ft.; S.D.

DE WITT COUNTY

C. B. Bunte, Inc.'s No. 1 Emil Buckhorn, SE cor. of 120-ac. tract in Andrew Lockhart Sur., 3 miles SW from Lindeneau ..... T.D. 3,318 ft.; coring for Pettus sand.

L. G. Wade's No. 1 fee, 6 mi. S from Yoakum, 530 ft. from NW line, 160 ft. from SW line of 35-ac. tract in Lavina Dunbar Sur. ..... T.D. 2,257 ft.; S.D.

DUVAL COUNTY

Al Buchanan et al's No. 1 Duval County Ranch Co., 1,650 ft. from E line, 990 ft. from S line of S½ of N½ of Sur. No. 206 ..... T.D. 1,483 ft.; flowed 20 bbls. hrly.; filled 250 bbls.; shut in for storage; est. 500 bbls. hrly.

S. B. Cloyes' No. 1 Hagist, 3,630 ft. from E line, 2,310 ft. from S line of B.S.&F. Sur. No. 265 ..... T.D. 600 ft.; drlg.

Eaton et al's No. 1 Herbst, 1,650 ft. from E line, 330 ft. from S line in S.A.&M.G. Sur. No 71 ..... Standing.

O. W. Killam's No. 2 Wood-Welder, 3,658 ft. from S line, 900 ft. from W line of Sur. No. 102 ..... T.D. 1,050 ft.; drlg.

S. S. & H. Oil Co.'s No. 1 Hunter, 330 ft. W of CEL of J. Poitevant Sur. No. 515 ..... T.D. 2,939 ft.; drlg. sand 2,638-58 ft.; dry.

W. A. Smith's No. 1 Holsapfel, west central part of lease in 900 ft. W of NE cor. of Sur. 344 and 150 ft. from N line of Sur. No. 42 ..... T.D. 398 ft.; standing waiting on water.

Trinity Drillers' No. 1 Hagist, 1,650 ft. from S line, 2,310 ft. from E line of B.B.B.&C. Sur. No. 1 ..... Drlg. below surface csg.

Whitting's No. 1 Duval County Ranch Co., 1,511 ft. from S line, 2,143 ft. from W line of Blk. 21, of Sur. No. 196 ..... T.D. 1,375 ft.; drlg.

EDWARDS COUNTY

Love and Evans' No. 1 Steve Brown, 660 ft. from N and E lines of Sec. 66, G.W.T.&P.R.R. Sur., 15 miles W of Rock Springs ..... T.D. 2,637 ft.; S.D. for csg. to shut out wtr.

FRIO COUNTY

Amerada Pet. Corp.'s No. 1 Frank Doering, 34 ft. from W line, 1,700 ft. from S line of Tract No. 7 in Maria Louisa Carranza Sur. No. 302 ..... T.D. 5,680 ft.; drlg. chalk.

GILLESPIE COUNTY

Powers et al's (Nixon-Dore) No. 1 Andrew Lindig, 18 mi. E of Fredericksburg ..... T.D. 1,194 ft.; fishing.

GONZALES COUNTY

Volz & Shelling's No. 1 Bennett Botts et al, 150 ft. from W line, 300 ft. from N line of 420-ac. tract, lease in Gonzales Sur. ..... T.D. 500 ft.; drlg.

GUADALUPE COUNTY

A. F. Barnhill's No. 3 F. A. Phullman, 1,300 ft. from N line, 152 ft. from E line of lease in L. Bollinger Sur. ..... Moving in rig.

O. W. Killam's No. 1 fee, 710 ft. from NE line, 658 ft. from NW line of 47.3-ac. tract in Green DeWitt Sur. No. 13 ..... Derrick.

Clint Lanier's No. 1 L. D. Hill, 450 ft. from NW line, 1,450 ft. from NE line of George Allen Sur. ..... T.D. 610 ft.; S.D.

L. E. Trout's No. 1 Mrs. M. McKee, 650 ft. from W and 150 ft. from N line of 239-ac. tract in Green Dewitt Sur., 4 miles SW from Darst Creek ..... Moving in rig.

W. J. Walton and H. H. Weinert's No. 1 Sorrell, 1,350 ft. from S line, 300 ft. from E line of Sorrell tract in Manuel Ximines Sur. ..... T.D. 2,315 ft.; drlg. Taylor marl.

HIDALGO COUNTY

Carl & Johnston's No. 1 Doughty, 187 ft. from S and E lines of Lot 11, Blk. 5 of Subd. of Indios Ranch Sur. in N. Hidalgo ..... T.D. 3,040 ft., S.D.

Chancellor & Hall's No. 1 Garcia Land & Cattle Co. 150 ft. from W line of Porcion 42 and 150 ft. N of old Military Highway ..... T.D. 3,187 ft.; standing

Maxwell & Young's No. 1 King, 175 ft. from N and E lines of Lot 8, Blk. 16, Alamo tract ..... T.D. 875 ft.; drlg.

JACKSON COUNTY

Ed Parson et al's No. 1 Clark, 300 ft. from S and W lines of R. J. and M. Clark lease in A. S. White Sur. ..... Derrick.

JIM HOGG COUNTY

D. C. DeWitt's No. 1 A. G. Lopez, 3,475 ft. from W line, 425 ft. from N line of Sur. No. 106 ..... T.D. 2,510 ft.; fishing.

Brooklyn Oil Co.'s No. 1 De La Garza, 660 ft. from N and W lines of Blk. 87 of Pippins Subd. of Randado Grant Sur. ..... T.D. 1,370 ft.; drlg.

KARNES COUNTY

Arrowhead Drlg. Co.'s No. 1 Rudd, 1,320 ft. from S and E lines of 524-ac. tract in Adriance Sur. ..... T.D. 850 ft.; drlg.

KENDALL COUNTY

H. W. Martin's No. 1 Houston, in F. Wright Sur. .. T.D. 1,987 ft.; standing.

W. E. Waldrip's No. 1 Charles Meckel, 300 ft. from E line, 3,300 ft. from S line of Thos. J. Sweeney Sur. No. 10 ..... T.D. 150 ft.; drlg.

KERR COUNTY

J. E. Anderson's No. 1 J. D. Witt, 1,320 ft. from N line, 1,320 ft. from W line of Sec. 1,933, in Hamilton Sur., 4 miles S of Center Point ..... T.D. 1,985 ft.; standing in shale and sand.

Evans & Gant's No. 1 Love, 660 ft. S of S line of Sur. 1,597, 1,320 ft. from W line of Sur. 1,594 ..... T.D. 4,060 ft.; rigging up to deepen.

Van Duyn & Moore's No. 1 Nowlin, 2,000 ft. from E line, 2,200 ft. from N line of Jas. R. Bettner Sur. No. 93 ..... T.D. 1,035 ft.; drlg.

LA SALLE COUNTY

W. H. Wallace's No. 1 H. C. Yeager, 150 ft. from S and E lines of Sur. No. 95 ..... T.D. 1,650 ft.; drlg.

LIVE OAK COUNTY

J. H. Durbin's No. 2 Marbach, 1,000 ft. from S line, 3,200 ft. from W line of S. Hays Sur. ..... T.D. 904 ft.; moving rig back, will try to make well.

Holland Oil Co.'s No. 1 T. J. Lynn, 175 varas from E line, 54 varas from N line of 272-ac. tract in Sur. No. 171 ..... T.D. 3,600 ft.; dry and abd.; tested S.W.; Pettus sand 3,582 ft.

M. P. Howard's No. 1 Alexander, 2,700 ft. from N line, 150 ft. from E line of 500-ac. tract, 3 miles NE of Calliham ..... T.D. 1,223 ft.; cmt. failed to hold; preparing to pull csg.

McMULLEN COUNTY

Nixon & Foster's (C. B. Bunte) No. 1 Lowe, 1,320 ft. from NE line, 1,320 ft. from NW line, Sec. 132, A. Starr Sur. ..... T.D. 1,215 ft.; drlg.

L. W. Stieren's No. 1 Hortono, 1,000 ft. from N, 2,000 ft. from E line of Sur. on 3,089-ac. tract in J. M. Jean Sur. ..... T.D. 1,050 ft.; abd. dry.

Paul C. Teas' No. 3 Hagist, 330 ft. from N and W lines of Sec. 19 ..... Rigged up.

Paul C. Teas' No. 1 Hagist, 330 ft. from N and E lines of Sec. 181, 10 miles N from Government Wells.... T.D. 1,690 ft.; coring for Mirando sand; missed Government Wells sand.

Paul C. Teas' No. 2 Hagist, 330 ft. from N and W lines of Sec. 25, Blk. 5, of H.&T.C.R.R. Sur. ..... T.D. 1,265 ft.; drlg.

MEDINA COUNTY

O. R. Framme's No. 1 E. Boelke, 987 ft. from N line, 660 ft. from E line of 102-ac. tract in S. Huth Sur. No. 10 ..... Spudding in.

MILAM COUNTY

Ed Clark et al's No. 1 Thomas Graves, 350 ft. from SW and NW lines of Jackson Hall Sur. ..... T.D. 890 ft.; shut down in shale

R. McCormick's No. 1 R. H. Humber, 37.5 acres, 150 ft. from SE and SW lines of tract in James McLaughlin Sur. ..... T.D. 550 ft.; drlg.

NUECES COUNTY

Banquette Oil Co.'s No. 1 T. C. Ingram, 330 ft. from N and W lines of 80-ac. tract, Blk. 6, Sec. 7, of S. R. Peters Sur. ..... T.D. 2,831 ft.; drlg.

A. C. Erwin's No. 1 Sagarin, 530 ft. from N, 160 ft. from E line of 35-ac. tract in Sec. 4, H. L. Kenney Sur. ..... T.D. 4,408 ft.; drlg.

S. F. Hurlbut and Southwest Oil Co.'s No. 1 Poenisch, center Blk. 2, Sec. 32, Flowerbluff & Encinal farm, 8 miles S from Corpus Christi ..... T.D. 2,300 ft.; drlg.; showing a little oil at 1,971 and 2,093 ft.

Texon Royalty Co.'s No. 1 E. McCoy, 330 ft. from W line, 3,830 ft. from S line, Sec. 3, of Palo Alto Sur., 6 miles SE from Agua Dulce ..... T.D. 3,400 ft.; showed a little oil at 3,180 ft.

SAN PATRICIO COUNTY

George W. Scruggs' No. 1 Collins, 1,040 ft. from NE line, 700 ft. from SE line of Blk. 36, E. J. McGloin Sur. .. .. T.D. 2,756 ft; dropped from report.

STARR COUNTY

Accumulative Royalty Co.'s No. 1 Martinez, 500 ft. from S line, 500 ft. from W line of C.C.S.D.&R. G.N.G. Sur. No. 217 ..... Spudded in.

S.A.D. Oil Co.'s No. 1 Crown Brick & Tile Co., 1,000 ft. S of State Highway No. 4 and 580 ft. from W line of Porcion 87, near La Puerta ..... T.D. 4,560 ft.; dropped till work starts.

Great Plains Oil Co.'s No. 1 Sanchez, 660 ft. from W line, 330 ft. from S line of SE NW of Sur. No. 344 .. T.D. 2,350 ft.; standing.

Goodwin & Yantis' No. 1 Kelsey Bass, 150 ft. from S and E lines of Blk. 8, Coast O. & G. Subd. of Secs. 2 and 3, Porcions 86-87 ..... T.D. 1,040 ft.; standing.

Goodwin & Yantis' No. 1 Seabury, 150 ft. from S and W lines of Sec. 107, Share No. 1, Porcion No. 107.... T.D. 2,095 ft.; no report.

Goodwin and Yantis' No. 2 Walker, 3,000 ft. from S line, 2,000 ft. from W line of Sur. No. 767 ..... T.D. 1,600 ft.; drlg.

Myers, Sullivan & Jenkins' No. 1 Starr County Cattle Co., 330 ft. from N line, 330 ft. from W line, Blk. 62, Porcion 89, Share 60 ..... T.D. 1,200 ft.; drlg.

R. D. Perkins & Hoffman's No. 1 E. A. Peffler, 3,090 ft. from W line, 2,480 ft. from S line of Sur. 933. T.D. 80 ft.; standing.

TRAVIS COUNTY

Franklin et al's No. 1-A Reimers, 1,200 ft. from SE line, 1,600 ft. from most southerly SW line of Sur. No. 35 ..... T.D. 710 ft.; standing.

Fritz Fuch's No. 2-B Smith est., 900 ft. from NW line, 300 ft. from W line of Blk. 16, L. Kimbro Sur. .... Rigged up and standing.

Watson, Johnson & Brady's No. 2 Brady ..... T.D. 1,345 ft.; abd.

Weaver & Osborn's No. 1 Will Reinhardt, 300 ft. from NW line, 1,200 ft. from NE line of Will Reinhardt 100-ac. tract in William Lewis, Jr., Sur. 2.... T.D. 248 ft.; standing.

UVALDE COUNTY

Evans & Thompson's No. 1 Farris, 400 ft. from S and W lines of 535-ac. tract near center of John J. Hammond Sur. ..... T.D. 460 ft.; no report.

John Roberts' No. 3 Kincaid ..... T.D. 385 ft.; standing.

O. A. Payte, No. 1 H. M. Waldrip, 160 ft. from S and W lines of G. Traute Sur. No. 471 ..... T.D. 1,040 ft.; S.D. in lime.

WEBB COUNTY

Merle Gunby's No. 1 A. M. Bruni, 1,252 ft. from W line, 328 ft. from S line of Sur. No. 857 ..... T.D. 2,310 ft.; drlg.

Will Ohlhausen's No. 1 Moses Jones, 273 varas from E line, 516 varas from S line of 100-ac. tract in Sur. No. 1,640 ..... T.D. 850 ft.; standing.

WILLIAMSON COUNTY

Alexander Drlg. Co.'s No. 1 J. & G. Kreig ..... T.D. 1,550 ft.; fishing.

Humble O. & R. Co.'s No. 1 Burns est., 825 varas from NW line, 1,495 varas from SW line of J. West Sur. Spudded in core test.

McLean et al's No. 2 R. C. Miller, 800 ft. to S line, 100 ft. to W line of tract, B. Manlove Sur. ..... T.D. 2,265 ft.; standing.

Pederson's No. 4 Forwood, 900 ft. from N and 1,200 ft. from E line of 160-ac. tract in Fisher Sur. ..... T.D. 652 ft.; standing.

Taylor Prod. Co.'s No. 1 Sladek, 130 ft. from SW line, 1,100 ft. from SE line of 195-ac. tract in H. White Sur. ..... T.D. 1,100 ft.; abd.; showed oil at 875-77 ft.

Wilson, Worley & Moore's No. 1 Mrs. M. E. Olive ..... T.D. 1,115 ft. in shale.

ZAPATA COUNTY

J. C. Charver's No. 1 Bustamento, 330 ft. from N and E lines of 24-ac. tract in Share 24 of Las Comitas grant ..... T.D. 1,290 ft.; drlg.

Hamilton, Brower & Crow's No. 1 Slator, 2,111 ft. from SW line, 1,980 ft. from SE line of Blk. 1, Subd of Slator ranch in J. V. Borrego grant ..... T.D. 1,069 ft.; abd.

Circle W. Oil Co.'s No. 1 M. Garza est., 623 ft. from NW line and 699 ft. from SW line of Blk. 30, C. A. Douglas Subd. of Charco de la India grant ..... T.D. 1,370 ft.; drlg.

J. P. Doyle's No. 1 I. Ramirez, 150 ft. from NW and SW lines of Blk. 15, Share 1, Porcion 18 ..... Spudded in and S.D.

Sarah Poppas' No. 1 Juan V. Cueller, Jr., 150 ft. from NE and SE lines of Blk. 3, Sur. 2 of Poppas Subd. of Por. 34 ..... T.D. 770 ft.; standing.

A. C. Savey et al's No. 1 Flores, 150 ft. from NW line, 206 ft. from NE line of Blk. 8, Share 1 of P. A. Richer Subd. of Porcion No. 38 ..... T.D. 2,404 ft.; standing.

ZAVALA COUNTY

Anglin O. & G. Co.'s No. 6 Pryor ..... T.D. 1,100 ft.; S.D.

Gavais O. & G. Co.'s No. 1 Gates, 1,320 ft. from N line, 1,320 ft. from E line of Hooper & Wade Sur. No. 13.. T.D. 4,054 ft; hole cleared; standing.

Southwest Texas Proven Areas

Week Ending October 21

CEDAR CREEK POOL—BASTROP COUNTY

Marts & Beavens' No. 1 C. A. Smith, 700 varas from SE line, 1,150 varas from NE line of C. A. Smith 415-ac. tract in James Blalock Sur. No. 7 ..... T.D. 418 ft.; drlg.

Marts & Beavens' No. 2 Orgain, 450 ft. from NW line, 150 ft. from NE line of Mrs. B. D. Orgain's 207.75-ac. tract in Addison Litton Sur. No. 1 ..... T.D. 454 ft.; drlg.

Joe Mills' No. 2 Voss, 160 ft. from NW and SW lines of Sallie A. Voss' 78.24-ac. tract in Addison Litton Sur. ..... T.D. 1,787 ft.; coring.

Joe Mills' No. 1 Noss, 400 ft. to E line, 150 ft. S of 78-ac. tract in Addison Litton Sur. ..... T.D. 1,874 ft.; abd.

NORTH DALE POOL—BASTROP COUNTY

Marts & Beavens' No. 4 C. L. Riddle, 2,200 ft. from SW line, 200 ft. from NW line of John Maxmillian Sur. No. 22 ..... T.D. 225 ft.; drlg.

Marts & Beavens' No. 3 Riddle, 685 ft. from NW line, 2,075 ft. from SW line of John Maxmillian Sur. .... Bldg. derrick.

Ogden & Reed's No. 1 Spradlin, 300 ft. from S line, 200 ft. from E line of 113-ac. tract in Grey Sur .Rigged up; standing

Ogden & Reed's No. 3 Riddle, from S cor. of Joshua Gray Sur. NE along SE line 760 ft. thence NW 150 ft. at right angles in Joshua Gray Sur. ..... T.D. 2,152 ft.; drlg. shale.

ECKERT POOL—BEXAR COUNTY

J. F. Harrison's No. 1 F. Gembler, 150 ft. from NW line, 480 ft. from NE line of 38-ac. tract in J Montez Sur. ..... T.D. 675 ft.; drlg.

Swearingen Oil Co.'s No. 14 Halbarcier, 700 ft. N of No. 3 on 93-ac. tract ..... T.D. 650 ft.; comp. 5 bbls. daily.

WEBSTER POOL—CALDWELL COUNTY

C. J. Webster Oil & Gas Co.'s No. 1 Fulps, 150 ft. from E line, 225 ft. from S line of tract in John A. Neill Sur. ..... T.D. 2,395 ft.; P.B. to chalk.

BUCHANAN POOL—DUVAL COUNTY

R. D. Kelly's No. 1 Foster, 330 ft. from N line, 1,650 ft. from E line of S½ of Sur. No. 206 ..... Rigging up.

EAST COLE FIELD—DUVAL COUNTY

Cole Petroleum Co.'s No. 1 S. Benavides, 150 ft. from SW line, 347 ft. from SE line, Blk. 347, Myrtle E. Hill Subd., Mariana Arispe grant ..... T.D. 2,824 ft.; abd.

ECKERT POOL—DUVAL COUNTY

F. H. Eckert & Son's No. 8 Louis Brehm, 650 ft. from W line, 150 ft. from S line of 95-ac. tract in P. L. Buguor Sur. ..... Spudding in; the test previously reported as a completion should have been No. 12 instead of No. 8.

NORTH GOVERNMENT WELLS POOL—DUVAL COUNTY

Central Producers, Inc.'s No. 2 Wendt, 330 ft. from N line, 150 ft. from E line of NE NE Sur. No. 43.... T.D. 2,308 ft.; comp. 25 bbls. hrly. on ⅝-in. choke.

Rodney DeLange's No. 1 Lundell, 330 ft. from S line, 150 ft. from E line of SW of Sur. No. 60 ..... T.D. 1,700 ft.; drlg.

Hamill & Hamill's No. 7 Hahl, 330 ft. from S line, 990 ft. from E line of N½ of SE of Sur. No. 42 .. T.D. 2,294 ft.; comp. 30 bbls. hrly.

Highland Oil Co.'s No. 8 Lundvall, 330 ft. from S and E lines of J. Poitevant Sur. No. 42 ..... T.D. 2,308 ft.; comp. 25 bbls. hrly.

Hamill & Hamill's No. 8 C. W. Hahl, 330 ft. from S line, 990 ft. from W line of N½ of SE of Sur. No. 42 ..... T.D. 1,910 ft.; drlg.

Humble Oil & Refining Co.'s No. 13 Hahl, 2,670 ft. from S line, 330 ft. from W line of E half of Sur. No. 360. T.D. 2,304 ft.; comp. 25 bbls. hrly.

Humble Oil & Refining Co.'s No. 15 Hahl, 330 ft. from N and W lines of E half of Sur. No. 360 ..... T.D. 2,308 ft.; comp. 55 bbls. hrly.

Humble O. & R. Co.'s No. 16 Hahl, 990 ft. from S line, 990 ft. from W line of E½ of Sur. No. 360 .. .... T.D. 2,315 ft.; comp. 30 bbls. hrly.

Humble Oil & Ref. Co.'s No. 17 Hahl, 1,650 ft. from S line, 990 ft. from W line of E½ of Sur. No. 360 .. T.D. 2,297 ft.; set csg.; W.O.C.

Humble O. & R. Co.'s No. 18 C. W. Hahl, 2,990 ft. from S line, 990 ft. from W line of E½ of Sur. No. 360. T.D. 1,510 ft.; drlg.

Humble O. & R. Co.'s No. 21 C. W. Hahl, 5,030 ft. from S line, 990 ft. from W line of E½ of Sur. No. 360.. Rigging up.

Kot Oil Co.'s No. 1 Lundell, 150 ft. from S and E lines of S½ of NW, Sur. No. 48 ..... Rigging up.

Magnolia Pet. Co.'s No. 2 Duval County Ranch Co., 330 ft. from S line, 936 ft. from E line of Sur. No. 208 ..... T.D. 2,318 ft.; comp. 16 bbls. hrly.

Magnolia Pet. Co.'s No. 7 Allen, 330 ft. from N line, 990 ft. from E line of S½ of SE Sur. No. 42 ..... T.D. 2,276 ft.; set csg.; W.O.C.

Navarro Oil Co.'s No. 11 Hahl, 330 ft. from N and W lines of W¼ of Sur. No. 360 ..... T.D. 2,305 ft.; testing.

Navarro Oil Co.'s No. 25 Hahl, 330 ft. from N line, 990 ft. from E line of W½ of Sur. No. 360 ..... T.D. 2,307 ft.; comp. 15 bbls. hrly.

Navarro Oil Co.'s No. 24 Hahl, 990 ft. from N and E lines of W½ of Sur. No. 360 ..... Rigging up.

Navarro Oil Co.'s No. 26 Hahl, 990 ft. from S and W lines of W½ of Sur. No. 360 ..... Rigging up.

Navarro Oil Co.'s No. 28 Hahl, 2,310 ft. from S line, 990 ft. from W line, W half of Sur. No. 360 ..... T.D. 2,276 ft.; comp. 25 bbls. hrly.

Navarro Oil Co.'s No. 29 Hahl, 2,970 ft. from S line, 990 ft. from W line, W half of Sur. No. 360 ..... T.D. 2,278 ft.; comp. 35 bbls. hrly.

Navarro Oil Co.'s No. 30 Hahl, 1,650 ft. from N line, 990 ft. from W line of W½ of Sur. No. 360 ..... Rigging up.

Reynosa Oil Corp.'s No. 4-B Duval Ranch Co., 330 ft. from S and E lines of E½ of SE, Sur. No. 363 ..... Drlg. below surface csg.

Reynosa Oil Corp.'s No. 5-A Duval Co. Ranch Co., 330 ft. from S and E lines of N half of SW of Sur. No. 362 ..... T.D. 2,286 ft.; comp. 28 bbls. hrly.

Russ Pet. Co.'s No. 2 Riley, 330 ft. from N and E lines of SW NW of 40-ac. tract in Sec. 45 ..... T.D. 1,590 ft.; topped Cole sand.

Sun Oil Co.'s No. 6 Weiderkehr, 660 ft. N of No. 4, Sur. No. 359 ..... T.D. 2,287 ft.; comp. 15 bbls. hrly.

Sun Oil Co.'s No. 7 Weiderkehr, 330 ft. from N and W lines of Sur. No. 359 ..... Rigging up.

Sun Oil Co.'s No. 8 Weiderkehr, 1,650 ft. from N line, 330 ft. from E line in Sur. No. 359 ..... Derrick.

Sun Oil Co.'s No. 10 Weiderkehr, 990 ft. from N line, 330 ft. from E line in Sur. 361 ..... Derrick.

SOUTH GOVERNMENT WELLS POOL—DUVAL COUNTY

Humble Oil & Refining Co.'s No. 11 Paul White, 1,310 ft. from E line, 1,000 ft. from S line of Sur. No. 249 .. T.D. 2,285 ft.; swabbing.

SARNOSA POOL—DUVAL COUNTY

L. W. Capps' No. 6-A Duval County Ranch Co., 330 ft. from SW line, 1,320 ft. from NW line of W¼ of Sur. No. 574 ..... Abd. location.

Violet Oil Co.'s No. 1, 330 ft. from NW line, 525 ft. from SW line of N half of Sur. No. 127 .. .. T.D. 2,525 ft.; abd. dry.

PETERS POOL—DUVAL COUNTY

Shasta Oil Co.'s No. 4 Peters, 990 ft. from E line, 330 ft. from S line of Strip, Sec. 65 ..... T.D. 2,494 ft.; W.O.; P.B. to gas sand at 1,733 ft.; W.O.C.

NEW BERLIN POOL—GUADALUPE COUNTY

J. A. Harper's No. 2 Rosenbrook, 660 ft. SW of No. 1.. T.D. 225 ft; set 10-in. csg.; W.O.C.

JACOBS POOL—McMULLEN COUNTY

Loma Oil Co.'s No. 19-A Jacobs, 930 ft. SE of No. 17-A, in G.H.&H. Sur. No. 7 ..... Spudded in.

Loma Oil Co.'s No. 18-A Jacobs, 660 ft. S of No. 11, in W. H. Jacobs Sur. No. 8 ..... Derrick.

Longhorn Oil Co.'s No. 3-A Lark, 450 ft. from N line, 150 ft. from W line of Blk. 14, of Subd. of Lark land in E. W. B. Scrugham Sur. ..... T.D. 1,008 ft.; recmtd. csg.

Kennon & Stephenson's No. 1 Lark, 150 ft. from N and W lines of Blk. 15, subd. of Lark land in E. W. B. Scrugham Sur. ..... T.D. 1,033 ft.; set csg.; W.O.C.

J. S. Suttle's No. 1 Lark, 150 ft. from N and W lines of Blk. 16, in E. W. B. Scrugham Sur. ..... T.D. 1,048 ft.; running tubing; est. 30 bbls. daily.

AGUA DULCE FIELD—NUECES COUNTY

H. F. Grimm's No. 1 Bluntzer, 300 ft. from W line, 3,100 ft. from S line of 639-ac. tract in Elliff Sur. ..Location.

CUEVITAS POOL—STARR COUNTY

Mims, Hamill & Evans' No. 1 M. Guerra, 330 ft. from E line, 330 ft. from S line of Share M-10, in Las Cuevitas grant ..... Location.

Sun Oil Co.'s No. 1-D Guerra, 6,353 ft. from NE line, 3,300 ft. from SE line of La Sacatosa grant ..... Rigging up.

Sun Oil Co.'s No. 2-C M. Guerra, 3,009 ft. from NW line, 660 ft. from NE line in Sacatosa grant ..... Rigging up.

Sun Oil Co.'s No. 5-A Guerra, 3,364 ft. from SW line, 6,595 ft. from SE of Share H-14-B of Las Cuevitas grant ..... T.D. 2,267 ft.; comp. 1,000 bbls. daily.

LOS OLMOS POOL—STARR COUNTY

Tarver and Nance's No. 8-A Kelsey Baza, 150 ft. from N line, 160 ft. from W line of SW SE Sec. 6, Porcions 75, 76, 77, Jurisdiction of Camargo ..... T.D. 450 ft.; comp. 7 bbls. daily.

CAROLINA-TEXAS POOL—WEBB COUNTY

Carolina-Texas Oil & Gas Trust's No. 11 Benavides, 150 ft. from S line, 600 ft. from W line of Blk. 13 in Sur. No. 683 ..... Rigging up; (first reported as Washington-Texas O. & G. Co.)

Washington-Texas O. & G. Co.'s No. 2 R. O. Barnsley, 150 ft. from E line, 450 ft. from N line of Blk. 16, Sur. 268 ..... T.D. 2,020 ft.; drlg.

MOCA POOL—WEBB COUNTY

D. R. Semmes' No. 4 Duval Ranch Co., 510 ft. from N line, 1,690 ft. from E line, Blk. 22, Share 3, Zapata School Land Sur. ..... T.D. 860 ft.; coring deeper; tested little gas and oil.

ESCOBAS POOL—ZAPATA COUNTY

Allied O. & G. Co.'s No. 12 Bustamente, 3,665 ft. from SE line, 750 ft. from NE line of Share 4, Fansler partition in Comitas grant ..... T.D. 1,276 ft.; comp. 30 bbls. dly.

S. R. & C. Oil Corp.'s No. 2-C Trevino, 330 ft. from S line, 330 ft. from W line of N½ of Blk. 13, in Sur. No. 413 ..... Location.

Texas Co.'s No. 43 Whitehead, 1,722 ft. from SE line, 19,507 ft. from SW line of Cerrito Blanco grant ... T.D. 1,206 ft.; testing.

JENNINGS POOL—ZAPATA COUNTY

United Prod. Corp.'s No. 11 Measles, 2,483 ft. from NW line, 16,500 ft. from SW line of Cerrito Blanco grant ..... T.D. 2,875 ft.; testing sand 2,867-75 ft.

Wildcat Operations in Louisiana-Arkansas

(Continued from Page 118)

POINSETT COUNTY

Ark. State O. & G. Co.'s No. 1 fee, C NE NE Sec. 13-11-3e ..... Derrick.

UNION COUNTY

Chas. Steele's No. 1 J. B. Combs, 150 ft. N, 185 ft. W, SE cor. SW NW Sec. 25-18-16 ..... Rigging up.

WOODRUFF COUNTY

John Wadkins' No. 1 Rosser, Sec. 7-5n-2w ..... Began drlg. Sept. 2; cmtd. 10-in. 40 ft.; S.D. 1,300 ft.

Mississippi

JONES COUNTY

Snow-Black Pet. Co.'s No. 1 Watson, 600 ft. W, 210 ft. S, center, Sec. 24-7-13 ..... S.D. 4,387 ft.

LAMAR COUNTY

Lamar Oil Co.'s No. 1 Scott, NE NE Sec. 18-2n-14..... S.D. 3,010 ft.

MADISON COUNTY

H. A. Wilson,tr.'s No. 1 Copex, 200 ft. N and E, SW cor. SW NE Sec. 24-9-2e ..... Drlg. 1,815 ft.

NEWTON COUNTY

Bob Dalton et al's No. 2 Majura, SE SE Sec 25-6-11 ... S.D. 2,300 ft.

RANKIN COUNTY

Hill Bros. and Cleve Love's No. 1 Lancaster, C SW NW Sec. 27-5-5e ..... Derrick.

WALTHALL COUNTY

Mutual O. & G. Co.'s No. 1 Boyd, Sec. 24-2n-9e, SW cor. SW SE ..... Derrick pattern.

WARREN COUNTY

Orbet Drlg. Co.'s No. 1 R. L. Parker, 300 ft. E, CWL, Sec. 14-14-1e ..... Drlg. 920 ft.

Louisiana-Arkansas Proven Areas

North Louisiana

BOSSIER PARISH

Company, well, farm name, section and block—	Remarks:
United Gas Public Service Co.'s No. 3 Skannel, Sec. 14-17-12	Set 6⅝-in. 2,415 ft.

CADDO—BETHANY

N, 1,506 ft. E. SW cor. Sec. 17-16-16 .....
Tom Collins Pet. Co.'s No. 1 Gill & Lipscomb, 660 ft. Derrick.

CADDO PARISH—BETHANY

Calatex O. & G. Co.'s No. 1 Taylor, SW SE Sec. 34-17-16. Drlg. 2,112 ft.
Dillingham et al's No. 1 Kady est., 660 ft. S and W, NE cor. SE NE Sec. 33-16-16 ..... Set 10-in. 196 ft.

CADDO—HOSSTON

C. D. Whittaker et al's No. 3 Barker, 1,150 ft. N, 1,900 ft. E, SW cor. Sec. 21-22-15 ..... Drlg. 220 ft.

DE SOTO PARISH

Tom McKinney et al's No. 1 J. M. Nabors, 330 ft. N and E, SW cor. SE SE Sec. 26-12-12 ..... Rig up.

LASALLE PARISH

H. L. Hunt, Inc.'s No. 7 Urania Lumber Co., 400 ft. S, 150 ft. W of C Sec. 2-9-1e ..... Set 10-in. 102 ft.; drlg. 200 ft.

RICHLAND PARISH

J. C. Prine's No. 1 Boughton, 1,360 ft. N, 1,920 ft. W, C Sec. 4-15-6 ..... Drlg. 2,340 ft.

SABINE PARISH—ZWOLLE

Baird Bros.' No. 1 Trammell, 600 ft. N, 330 ft. W, SE cor. NE Sec. 30-8-11 ..... W.O.S.R. 2,606 ft.
Baird & Reed's No. 1 Dew, 330 ft. N, 210 ft. E, SW cor. SW SE Sec. 22-8-11 ..... Dry; W.O. 2,580 ft.
J. C. Chandler's No. 1 Raina, SW cor. NW Sec. 14-7-11.. Bailing 2,503 ft.
Dyer et al's No. 1 McCollister, 330 ft. S and E, NW cor. SW NE Sec. 24-7-12 ..... Derrick (corrected).
Investors Prod. Co.'s No. 1 S. J. Williams, 600 ft. E and S, NW cor. Sec. 24-7-11 ..... Bailing 2,646 ft.
Magnolia Pet. Co.'s No. 2 Gindratt, 330 ft. N, 320 ft. E, SW cor. SE Sec. 30-8-11 ..... Derrick.
Pelican Nat. Gas Co.'s No. 25 La. Long Leaf, 584 ft. S, 300 ft. E, NW cor. NE NE Sec. 31-8-11 ..... Derrick.
Pelican Nat. Gas Co.'s No. 21 La. Long Leaf Lbr. Co., 660 ft. N, 568 ft. W, SE cor. SE SW Sec. 3-7-11..... Dry; W.O. 2,700 ft.
Pelican Nat. Gas Co.'s No. 24 La. Long Leaf Lbr. Co., 330 ft. N and E, SW cor. Sec. 5-7-11..... Bailed dry; W.O. 2,750 ft.
H. C. Pitts' No. 1 Trammell 330 ft. N and E, SW cor. NW NE Sec. 5-7-11 ..... Derrick.
Pugh-Hickman Drlg. Co.'s No. 9 Stille, Sec. 16-7-11, 330 ft. S and E, NW cor. SE NW ..... Drlg. 2,760 ft.
People's O. & G. Co.'s No. 1 Raines, 330 ft. N, 100 ft. W, SE cor. NE Sec. 15-7-11 ..... Set 6-in. 2,431 ft.
Rig Oil Co.'s No. 1 Walden, 330 ft. N and E, SW cor. NW NE Sec. 28-8-11 ..... Derrick.
C. T. Ruffin's No. 1 McNeely, 510 ft. S, 330 ft. W, NE cor. NE NE Sec. 7-7-11 ..... Tested dry 2,550 ft.; S.D.
L. J. Tillery's No. 1 Sabine Lbr. Co., 800 ft. S, 220 ft. W, NE cor. Lot 3, La. Nava grant, Sec. 5-7-11..... Rigged up and S.D.
C. H. Tuttle's No. 4 Byrd, 800 ft. S, 930 ft. E, NW cor. NW NW Sec. 7-7-10 ..... Drlg. 1,965 ft.

Mississippi

HINDS COUNTY

Hensley & Tanner's No. 1 Hudson, 1,300 ft. N, 1,500 ft. W, SE cor. Sec. 11-5-1e ..... Drlg. plug 2,399 ft.
Love & Lancaster's No. 2 Elton plantation, NE Sec. 9-4-1e ..... S.D. 5 ft.
Meredith Trading Co.'s No. 1 Nelson et al, 630 ft. E, 330 ft. S, NW cor. SW SE Sec. 24-6-1e ..... Rigging up.
United Gas Public Service Co.'s No. 1-C McLaurin, Sec. 19-6-2e, C SE ..... Corrected depth 2,632 ft.; S.D.

RANKIN COUNTY

Ferguson, Fuller & Metz' No. 1 Ammons, 360 ft. E and S, NW cor. NW NW Sec. 35-3n-3e ..... Rigged up.
Love Pet. Co.'s No. 2 fee, Sec. 31-6-2e, 835 ft. N, 25 ft. E of SW cor. ..... S.D. 719 ft.
Cleve Love et al's No. 1 Thomas, SW Sec. 10-4-1e..... Derrick.
Muse & Muse's No. 1 Carlton, Sec. 13-3n-1e, 650 ft. E, 725 ft. N, SW cor. ..... Cmtd. 6-in. 2,407 ft.

EAST TEXAS (Border Counties)

MARION COUNTY

Perry et al's No. 1 E. B. Colgin, 300 ft. N and E, SW cor. Martin Noll Sur. ..... S.D. 1,400 ft.

PANOLA COUNTY

W. H. Nichols et al's No. 1 S. W. Ray, 330 ft. S of N line, 330 ft. W of E line, W. P. Culver Sur. ..... Drlg. 515 ft.
M. H. Robbins et al's No. 1 Alsee Williams, 165 ft. N and E, SW cor. 20-ac. tract in Winnie Mann Sur. .. Rigging up.
C. R. Obermeyer et al's No. 1 T. J. Wooten, P. Martin Sur. ..... Drlg. 372 ft.